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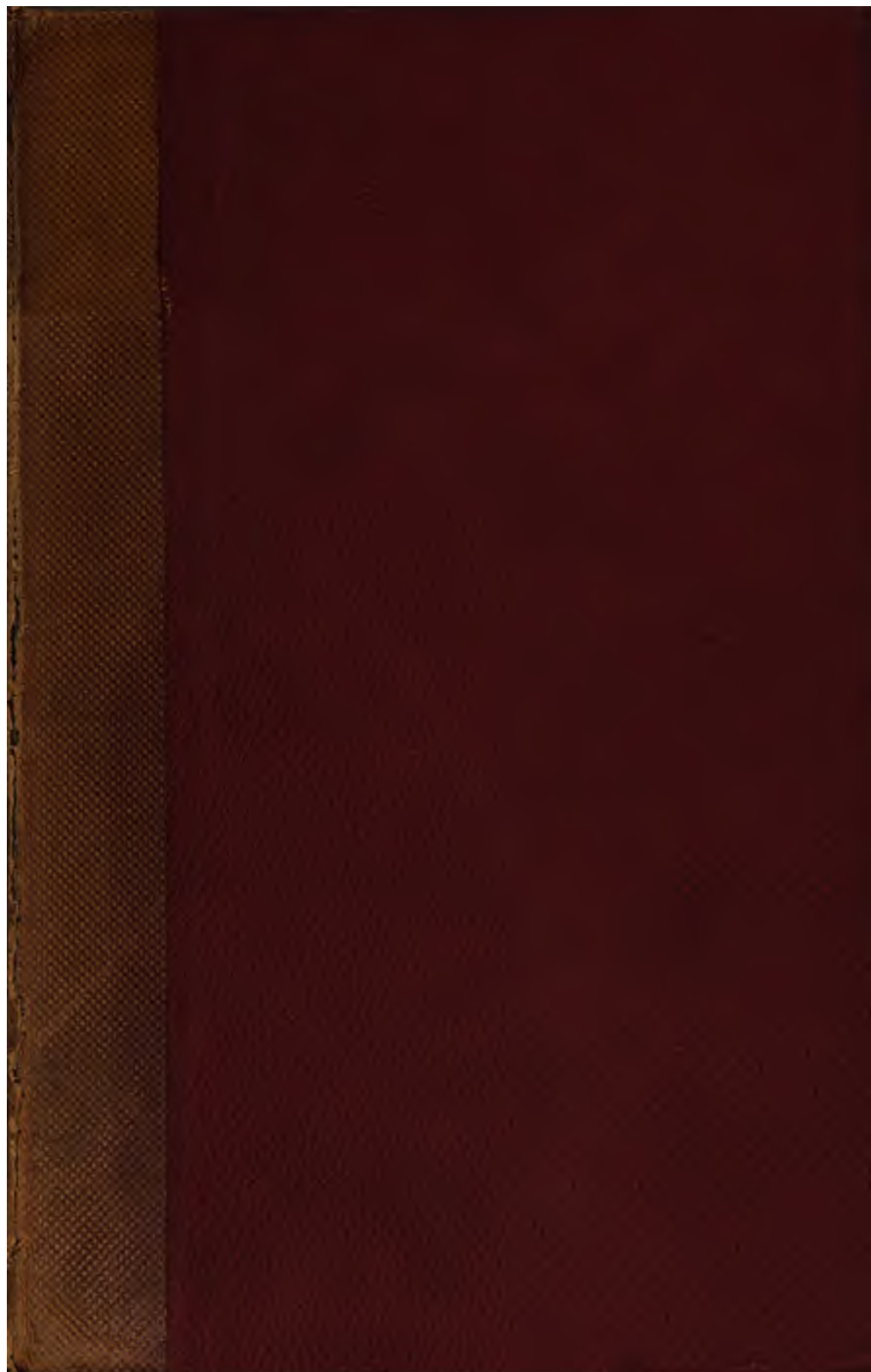
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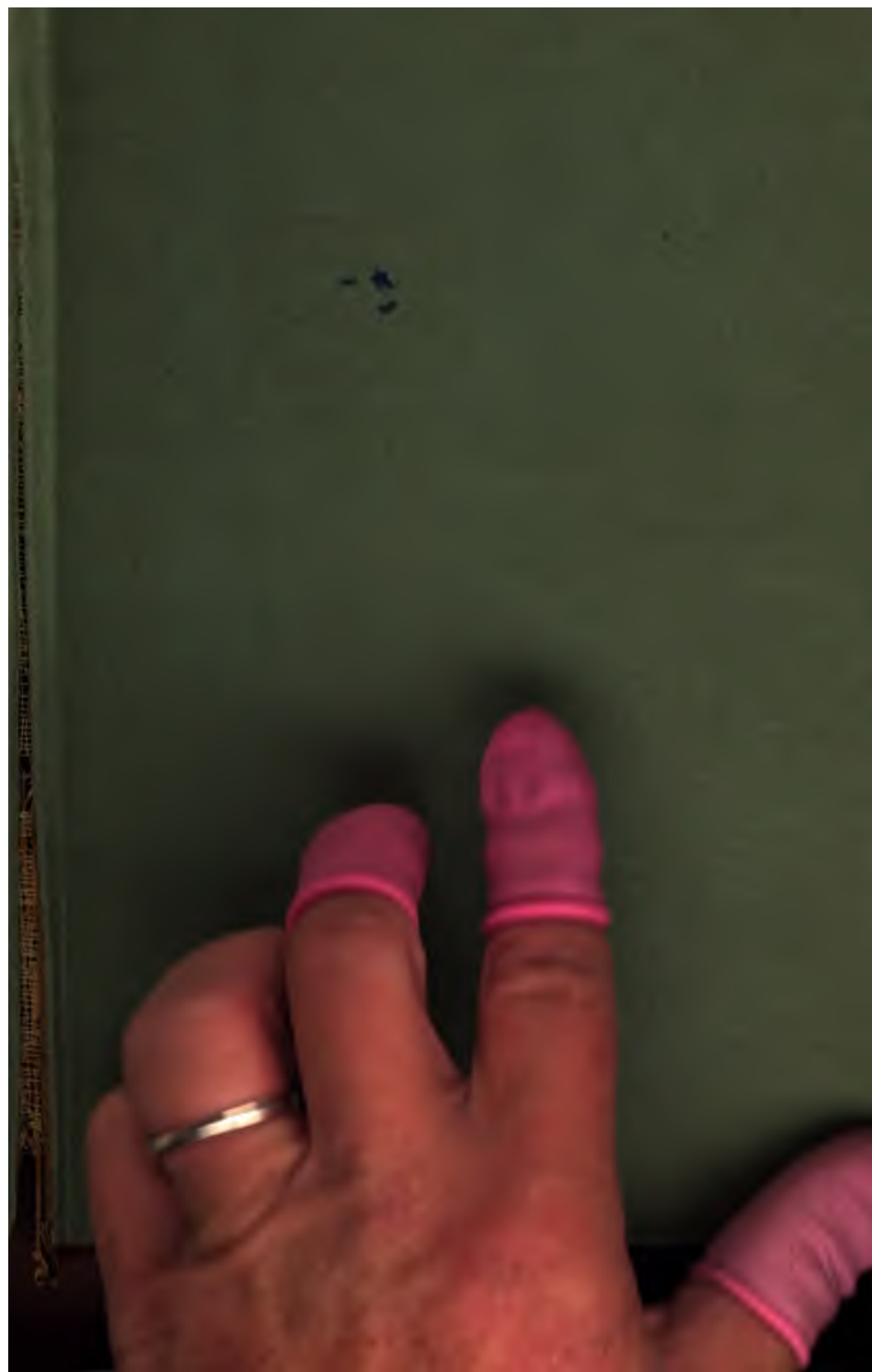
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THE
FOSSIL FLORA
OF
GREAT BRITAIN;
OR,
FIGURES AND DESCRIPTIONS
OF THE
VEGETABLE REMAINS FOUND IN A FOSSIL STATE
IN THIS COUNTRY.

BY
JOHN LINDLEY, Ph.D. F.R.S. &c.
PROFESSOR OF BOTANY IN UNIVERSITY COLLEGE, LONDON;
AND
WILLIAM HUTTON, F.G.S. &c.

"Avant de donner un libre cours à notre imagination, il est essentiel de rassembler un plus grand nombre de faits incontestables, dont les conséquences puissent se déduire d'elles-mêmes."—*Sternberg*.

VOLUME III.

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THE
FOSSIL FLORA.

NOTE
UPON THE VALUE OF NUMERICAL PROPORTIONS IN
THE ANCIENT FLORA OF THE WORLD, WITH RE-
FERENCE TO A DETERMINATION OF CLIMATE.

BY PROFESSOR LINDLEY.

“Si nous comparons cette flore ancienne avec les flores des diverses régions du globe, sous le point de vue de la proportion numérique des espèces des différentes classes, nous n'en trouverons aucune qui lui soit complètement analogue ; mais nous verrons que plus ces flores appartiennent à des espaces de terre plus circonscrits au milieu d'étendues d'eau plus vastes, c'est à dire à des îles plus petites et plus éloignées des continens, et plus elles se rapprochent par la proportion des diverses familles de ce que nous connaissons dans les terrains houillers. Suivant l'observation faite en premier, je crois, par M. B. Brown, et qui a été développée depuis par M. d'Urville, les Fougères et les Lycopodes paroissent soumises à deux influences différentes, qui déterminent les nombres des espèces de ces familles par rapport au nombre total des végétaux phanérogames : la température

est une de ces causes ; l'influence de l'air humide et de la température uniforme de la mer, paraît être l'autre. Il en résulte que dans les localités également favorisées sous le rapport de ces dernières circonstances, ces plantes sont plus fréquentes dans la zone équatoriale que dans les zones plus froides ; mais que sous la même zone elles sont beaucoup plus abondantes dans les îles que sur les continents. Nous pourrions citer de nombreux exemples à l'appui de cette proposition, mais ce n'en est pas ici le lieu ; nous dirons seulement que dans les parties les plus favorables au développement de ces plantes sur le continent de l'Europe tempérée, leur rapport aux phanérogames est comme 1:40, tandis que dans les mêmes circonstances, dans les régions continentales, entre les tropiques, M. R. Brown admet que ce rapport est comme 1:20, et dans les cas moins favorables comme 1:26.

“ Sous la même latitude cette proportion devient bien plus grande dans les îles : ainsi, dans les Antilles le rapport des Fougères aux plantes Phanérogames paraît être à peu près comme 1:10, au lieu de 1:20, qui est celui des parties les plus favorisées du continent Américain ; dans les îles de la mer du Sud, ce rapport, au lieu d'être 1:26, comme dans le continent de l'Inde et de la Nouvelle Hollande tropicale, devient 1:4, ou 1:3 ; à Sainte-Hélène et à Tristan d'Acugna la proportion de ces végétaux est comme 2:3 ; enfin, à l'île de l'Ascension, en ne considérant que les plantes évidemment indigènes, il paraît y avoir égalité entre les plantes Phanérogames et les Cryptogames vasculaires.

“ On conçoit donc que, si des îles analogues à celles que nous venons de citer, existaient seules sur la surface de notre globe au milieu d'une vaste mer, où elles ne formeraient que des sortes de points épars, la proportion de Fougères serait probablement encore plus grande, et, au lieu de l'égalité des deux grands groupes de végétaux que nous comparons, nous pourrions voir les Cryptogames vasculaires l'emporter de beaucoup sur les Phanérogames ; c'est ce qui a lieu dans le terrain houiller, et ces considérations de géographie botanique doivent déjà

nous porter à penser que les végétaux qui ont donné naissance à ces dépôts, croissaient sur des archipels d'îles peu étendues. La disposition des terrains houillers par lignes interrompues, qu'on a appelés des bassins et comparés à des successions de lacs ou à des vallées, est au moins aussi analogue à la disposition la plus fréquente des îles qui, représentant les crêtes de chaînes de montagnes sous-marines, sont généralement placées en séries; enfin le morcellement du terrain houiller, et au contraire la vaste étendue et la continuité des terrains de calcaire de transition, qu'on peut considérer comme les dépôts formés dans la mer qui environnait ces îles, nous semblent confirmer cette hypothèse." *Adolphe Brongniart, Prodr. p. 181.*

Such were the opinions entertained by Monsieur Adolphe Brongniart in the year 1828, and such are probably the opinions of many Geologists at the present day; for there certainly has as yet been nothing done or discovered to call their soundness in question.

It however always appeared to me very doubtful whether such data as we possessed concerning the Flora of the Coal Measures could be considered of a nature sufficiently precise to justify Geologists in entering into such calculations, in which, for them to be of any value whatever, a full knowledge of all facts is obviously indispensable. It was, moreover, perfectly clear that the numerical proportion borne by Ferns to other plants was rapidly diminishing as the examination of the vegetable remains of the Coal Measures became more carefully conducted. The very remarkable fact that Ferns are scarcely ever met with in fructification in a fossil state was also a circumstance upon which no light

was thrown by the theory of a high temperature, and damp insular atmosphere.

Taking all these into consideration, along with the constant state of disintegration of vegetable remains—a disintegration unquestionably not the result of drifting—I was led to suspect that possibly the total absence of certain kinds of plants, the as constant presence of others, and several other points of a like nature, might be accounted for by a difference in the capability of one plant beyond another of resisting the action of water.

Accordingly, on the 21st of March, 1833, I filled a large iron tank with water, and immersed in it 177 specimens of various plants, belonging to all the more remarkable natural orders, taking care in particular to include representatives of all those which are either constantly present in the Coal Measures, or as universally absent. The vessel was placed in the open air, left uncovered, and left untouched, with the exception of filling up the water as it evaporated, till the 22nd of April, 1835, that is, for rather more than two years. At the end of that time what remained was examined with the results stated in the following list; in which it is to be observed that where no observation is added to the name of a plant, no trace whatever of that species could be found.

ACOTYLEDONES.

<i>Fungi.</i>	<i>Result.</i>
1 <i>Boletus suberosa</i> .	A black shapeless mass.
2 ——— <i>versicolor</i> .	Ditto.
3 ——— <i>sp.</i>	Ditto.
<i>Lichenes.</i>	
4 <i>Peltidea canina</i> .	
5 <i>Parmelia saxatilis</i> .	
6 <i>Thelotrema pertusum</i> .	
<i>Hepaticæ.</i>	
7 <i>Marchantia polymorpha</i> .	
<i>Musci.</i>	
8 <i>Hypnum striatum</i> .	
9 ——— <i>sericeum</i> .	
10 <i>Dicranum purpureum</i> .	
11 ——— <i>scoparium</i> .	
12 <i>Bryum undulatum</i> .	
13 <i>Polytrichum commune</i> .	
<i>Filices.</i>	
14 <i>Aspidium Filix-mas</i> .	In good condition, but the fructification rotted off.
15 ——— <i>aculeatum</i> .	Ditto ditto.
16 <i>Pteris aquilina</i> , (dead leaves.)	Much broken and decayed, scarcely to be recognized.
17 <i>Scolopendrium vulgare</i> .	Good condition, no fructification.
18 <i>Polypodium vulgare</i> .	Recognizable but decayed.
19 ——— <i>cambricum</i> , (dead leaves.)	
<i>Lycopodiaceæ.</i>	
20 <i>Lycopodium Phlegmaria</i> , (dried.)	Good condition.
<i>Equisetaceæ.</i>	
21 <i>quisetum hiemale</i> .	
22 ——— <i>variegatum</i> .	

DICOTYLEDONES.

*Cycadeæ.*1 *Zamia horrida*.2 ——— *elegans*.*Coniferae.*3 *Thuja orientalis*.4 ——— *occidentalis*.5 *Juniperus virginiana*.6 ——— *Sabina*.7 *Pinus Pineæ*.8 ——— *halepensis*.9 *Abies balsamea*.10 ——— *canadensis*.11 ——— *rubra*.12 ——— *Webbiana*.13 ——— *Cedrus*.14 *Cunninghamia lanceolata*.15 *Araucaria imbricata*.16 ——— *excelsa*.17 ——— *Cunninghami*.18 *Taxus baccata*.*Amentaceæ.*19 *Fagus sylvatica*, (dry leaves.)20 *Carpinus Betulus*, (ditto.)21 *Plantanus orientalis*, (ditto.)*Result.*

Pinnae quite perfect; but they had separated from their petiole, leaving a double range of oblique narrow holes in its front.

Quite perfect, except near the base where the pinnae had dropped off, leaving holes as in the last instance.

Decayed, but recognizable.

Ditto, ditto.

Many leaves fallen off; much decayed.

Good condition.

Leaves in good condition; but mostly fallen off.

Ditto, ditto.

Ditto, ditto.

Ditto, ditto.

Very perfect; leaves still adhering.

All the leaves fallen off; bad condition.

Nearly perfect.

Quite perfect.

Branch only left, leaves lost; not distinguishable.

22	<i>Quercus Ilex.</i>	}	<i>Result.</i>
23	——— <i>suber.</i>		Good condition.
24	——— <i>austriaca.</i>		
25	——— <i>pedunculata, (dry leaves.)</i>		
26	——— <i>Cerris, (ditto.)</i>		Recognizable.

Miscellaneous Apetalæ.

27	<i>Buxus communis.</i>		
28	——— <i>balearica.</i>		Good condition.
29	<i>Croton variegatum.</i>		
30	<i>Myrica cerifera.</i>		Tolerably perfect.
31	<i>Rumex Patientia.</i>		
32	<i>Coccoloba uvifera.</i>		Perfect.
33	<i>Laurus foetens.</i>		
34	——— <i>camphora.</i>		Reduced to a skeleton.
35	<i>Casuarina equisetifolia.</i>		Nearly perfect.
36	<i>Dryandra speciosa.</i>		Tolerably perfect.
37	<i>Ficus Brassii.</i>		
38	——— <i>elastica.</i>		Nearly perfect.

Polypetalæ.

- 1 *Magnolia grandiflora.*
- 2 *Berberis glumacca.*
- 3 ——— *rupens.*
- 4 ——— *Aquifolium.*
- 5 ——— *fascicularis.*
- 6 *Hypericum calycinum.*
- 7 *Photinia serrulata.*
- 8 *Eucalyptus pulverulenta.*
- 9 *Myrtus communis.*
- 10 *Mimosa scandens.*
- 11 *Eugenia macrocarpa.*
- 12 *Schinus Litr.*
- 13 *Ligusticum Levisticum.*
- 14 *Gastonia palmata.*
- 15 *Sanguisorba officinalis.*
- 16 *Fragaria virginiana.*
- 17 *Eriobotrya japonica.*
- 18 *Prunus Lauro-cerasus.*

- 19 *Prunus lusitanica*.
- 20 *Acacia verticillata*.
- 21 *Bauhinia racemosa*.
- 22 *Spartium junceum*.
- 23 *Ceratonia Siliqua*.
- 24 *Spartium scoparium*.
- 25 ——— multiflorum.
- 26 *Brassica caulorapa*.
- 27 *Cereus speciosus*.
- 28 ——— brasiliensis.
- 29 *Saxifraga crassifolia*.
- 30 *Tellima grandiflora*.
- 31 *Oxalis acetosella*.
- 32 *Aristotelia Maqui*.
- 33 *Dodonaea triquetra*.
- 34 *Echeveria gibbiflora*.
- 35 *Cotyledon* sp.
- 36 *Francoa appendiculata*.
- 37 *Ribes punctatum*.
- 38 *Passiflora racemosa*.
- 39 *Hibiscus liliiflorus*.
- 40 *Reevesia sinensis*.
- 41 *Pterospermum acerifolium*.
- 42 *Astrapæa Wallichii*.
- 43 *Banisteria chrysophylla*.
- 44 *Helleborus odoratus*.
- 45 *Hedera Helix*.

Monopetala.

- 1 *Ilex Aquifolium*.
- 2 ——— balearica.
- 3 *Phillyrea obliqua*.
- 4 ——— latifolia.
- 5 ——— angustifolia.
- 6 *Jasminum revolutum*.
- 7 *Olea europæa*.
- 8 *Rhododendron ponticum*.
- 9 ——— azaleoides.
- 10 *Kalmia latifolia*.

Result.

In tolerable condition.
A perfect skeleton remaining.

Leaf reduced to a skeleton.

- 11 *Arbutus Unedo.*
- 12 *Andromeda calyculata.*
- 13 ————— *speciosa.*
- 14 ————— *pulverulenta.*
- 15 *Gaultheria Shallon.*
- 16 *Ledum latifolium.*
- 17 *Caprifolium implexum.*
- 18 *Viburnum sinense.*
- 19 ————— *Tinus.*
- 20 *Aucuba japonica,*
- 21 *Bignonia capreolata.*
- 22 *Acanthus mollis.*
- 23 *Bignonia adenophylla.*
- 24 *Gesneria bulbosa.*
- 25 *Gloxinia speciosa.*
- 26 *Theophrasta Jussiei.*
- 27 *Corynocarpus laevigatus.*
- 28 *Fagrea obovata.*
- 29 *Brexia spinosa.*
- 30 *Clerodendron hastatum.*
- 31 *Antirrhinum majus.*
- 32 *Rosmarinus officinalis.*
- 33 *Salvia officinalis.*
- 34 *Phlomis ferruginea.*
- 35 *Aster argophyllus.*
- 36 *Sonchus arboreus.*
- 37 *Brachyglottis repanda.*
- 38 *Mikania Guaca.*
- 39 *Tussilago fragrans.*
- 40 *Cyclamen europæum.*
- 41 *Primula sinensis.*

Result.

Much decayed.

Good condition.

Good condition.

Good condition.

Tolerably perfect.

MONOCOTYLEDONES.

Palmae.

- 1 *Phoenix dactylifera.*

Good preservation.

Miscellaneous.

- 2 *Yucca angustifolia.*
- 3 ——— *gloriosa.*
- 4 ——— *filamentosa.*

} Traces only left in the form of a
thin striated blade.

Result.

- 5 *Ruscus aculeatus*.
- 6 ——— *hypoglossum*.
- 7 ——— *racemosus*.
- 8 *Phormium tenax*.
- 9 *Peliosanthes Teta*.
- 10 *Dichorisandra thyrsiflora*.
- 11 *Tradescantia discolor*.
- 12 *Dracena terminalis*.
- 13 *Pancratium amœnum*.
- 14 *Doryanthes excelsa*.
- 15 *Tillandsia farinosa*.
- 16 ——— sp.
- 17 ——— sp.
- 18 *Ananassa sativa*.
- 19 *Iris Pseud-acorus*.
- 20 *Benealmia nutans*.
- 21 *Maranta zebrina*.
- 22 ——— *ramosissima*.
- 23 *Bletia Tankervilleæ*.
- 24 *Canna indica*.
- 25 *Caladium esculentum*.
- 26 *Arum Dracunculus*.
- 27 *Bambusa*.
- 28 *Poa aquatica*.
- 29 *Carex Ederi*.
- 30 ——— *pendula*.
- 31 *Juncus conglomeratus*.

Good condition.

Thin film only left.

Traces with the marginal spines
perfect ; otherwise they could
not have been recognized.

Good condition.

Good condition.

Besides these, small branches of *Elder*, *Oak*, *Horsechestnut*, *Plane*, *Sycamore*, *Poplar*, *Ash*, and *Laburnum*, were placed in the water ; when examined they had all lost their bark, and could no longer be distinguished by any external character.

<i>General Result of the preceding Experiment.</i>			
	Number of Species submitted to experiment.	Recognizable afterwards.	Not to be traced.
ACOTYLEDONES.			
Fungi	3	3	0
Lichenes	3	0	3
Hepaticæ	1	0	1
Musci	6	0	6
Filices	6	6	0
Lycopodiaceæ	1	1	0
Equisetaceæ	2	0	2
<i>Total.</i>	22	10	12
DICOTYLEDONES APETALÆ.			
Cycadeæ	2	2	0
Coniferæ	16	13	3
Amentaceæ	8	4	4
Miscellaneous	12	7	5
<i>Total.</i>	38	26	12
DICOTYLEDONES POLYPETALÆ	45	2	43
DICOTYLEDONES MONOPETALÆ	41	6	35
MONOCOTYLEDONES.			
Palme	1	1	0
Miscellaneous	30	11	19
<i>Total.</i>	31	12	19
<i>Total.</i>	177	56	121

This experiment appears to me to lead to most important conclusions. These things seem clear: firstly, that Dicotyledonous plants, in general, are unable to remain for two years in water without being totally decomposed; and that the principal

part of those which do possess the power, are *Coniferæ* and *Cycadeæ*, which are exactly what we find in a Fossil state; secondly, that Monocotyledones are more capable of resisting the action of water, in particular Palms and Scitamineous plants, which are what we principally find as Fossils, but that Grasses and Sedges perish; so that we have no right to say that the earth was not originally clothed with Grasses because we no longer find their remains; thirdly, that Fungi, Mosses, and all the lowest forms of vegetation disappear, and that even *Equisetum* leaves no trace behind, which seems to settle the question of *Calamites* being an extinct form of that genus; and, finally, that Ferns have a great power of resisting water, if gathered in a green state, not one of them having disappeared during the experiment; but that the effect of immersion in water is to cause their fructification to rot away.

Hence the numerical proportion of different families of plants found in a fossil state throws no light whatever upon the ancient climate of the earth, but depends entirely upon the power which particular families may possess, by virtue of the organization of their cuticle, of resisting the action of the water wherein they floated, previously to their being finally fixed in the rocks in which they now are found.

PECOPTERIS ACUTIFOLIA.

Neuropteris acutifolia. Murray MSS.

Found by Dr. Murray in a new bed of vegetable remains discovered by himself, at a spot where the Sandstone enclosing the shale, passing under the Cornbrash and Kelloway rock, was denuded by the falling of the rocks at the foot of the lofty cliffs which guard Redcliffe Bay ; just at the extreme of high water mark. It was accompanied as usual in these Oolitic rocks by jet and pyritous Dicotyledonous woods.

It appears to be a species of *Pecopteris*, distinct from any previously noticed, but is very like the following from the same locality ; differing, however, in its lobes being much more pointed. It is also allied to *Pecopteris tenuis*, but is smaller in all

its parts, and appears from the drawing to have much fewer secondary veins.

We have to thank Mr. Williamson, Jun., for the drawings and notes that accompanied them.

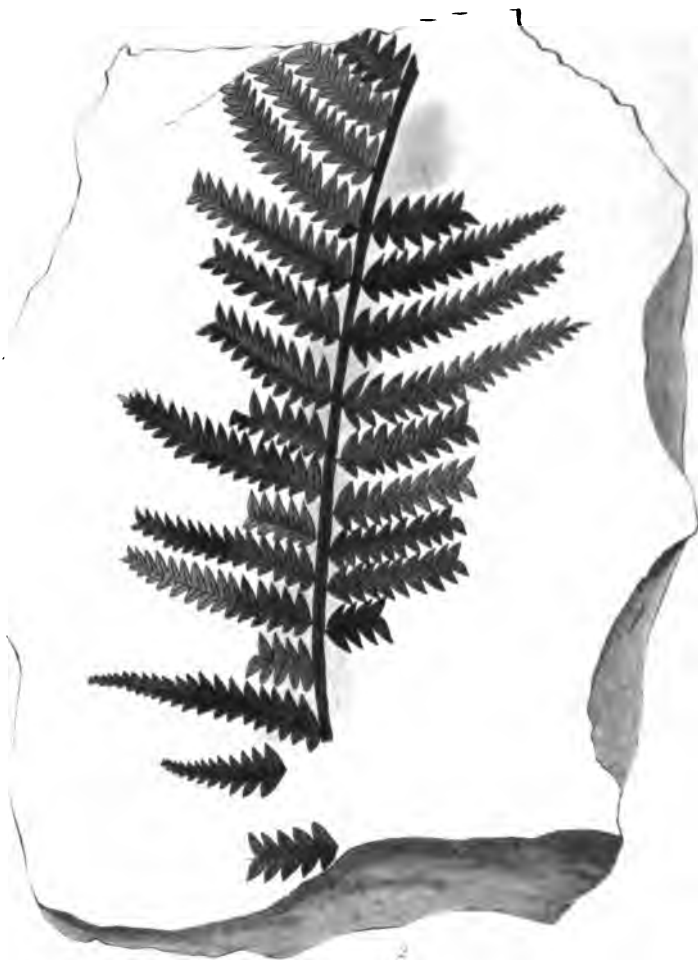
Fig. 1. c. represents a magnified view of a portion of a leaf of *Pecopteris obtusifolia* contrasted with a similar portion of the present species, *fig. 2. b.*



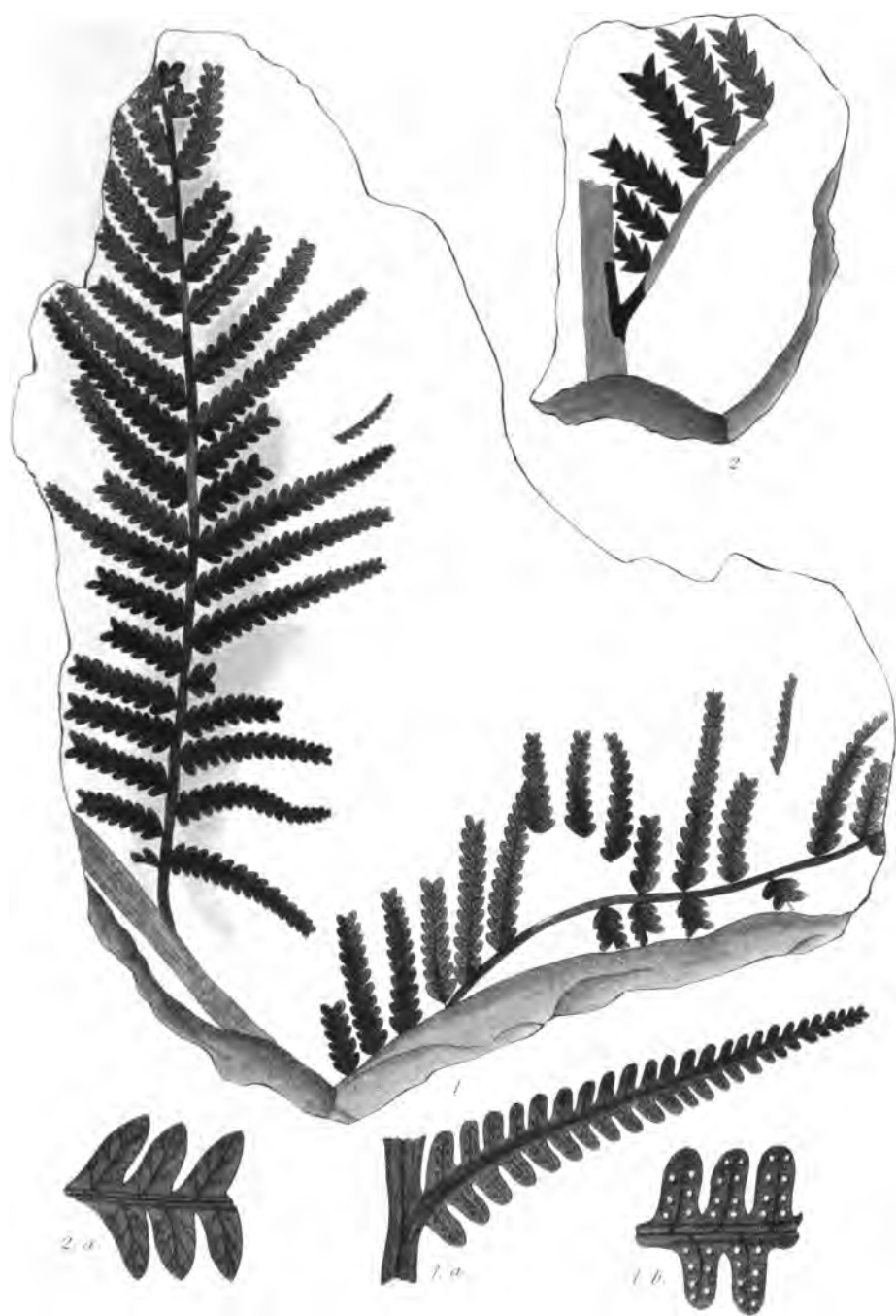


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F. Kuhnianus, dett

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PECOPTERIS OBTUSIFOLIA.

Neuropteris obtusifolia. *Murray MSS.*

Discovered with the last by Dr. Murray.

Mr. Williamson, Jun. has communicated the following note with his drawing.

“From the thickness of the small fragment of stem remaining it has been a bipinnated frond, of rather a large size. The stem, as is usual with Ferns, is irregularly grooved or striated; the central stalk of the pinnules is straight, gradually tapering, and has the strongly marked groove along the centre: but whether the pinnules have been opposite or alternate I cannot say. They are alternate and almost an inch in length. The midrib appears very small, but the centre of the pinnule is a little

prominent, as though from the pressure of a strong rib at the opposite side ; the lobes are small, blunt, alternate, and extremely regular ; attached by the whole of their base, which is but little broader than the apex. On each side of the midrib is a series of small sori, varying in number from 4 to 8, but generally 6 ; they appear as if unconnected with secondary veins, which are, however, visible in pinnules where there are no sori." See plate 157. 1. c.

Fig. 2. and 2. a. represent fragments of *Pecopteris acutifolia*.

SPHÆREDA PARADOXA.

“ A plant occurring in the lower Shale and Sandstone at Cloughton, and which seems to throw some light upon the nature of those singular spherical bodies often seen in the shale, both there and at Gristhorpe in the upper beds, and which hitherto have been called winged seeds. The fossil under consideration, has probably been the stem or radical shoots of a Plant very analogous to, if not quite identical with the existing genus *Pilularia*, which has round sporules attached by similar very short stalks to the main root, so short indeed as nearly to appear sessile, as they do in this specimen, but in others, the capsule may be traced with a short peduncle.

“The central supporting stem appears from its irregularity and general structure, more similar to a root than to the stem of any vegetable, especially as not any leaves can be observed in this or other specimens; and possibly it may be owing to the extreme fragility of roots that these seed vessels have been so rarely found in position.

“The structure of the capsules would seem to have consisted in an inner nucleus, protected by a very firm cortical case, which occasionally is separable, and which is an additional point of resemblance with the recent *Pilularia*, only that the extinct species must have been quite a giant to its present analogue.

“Now as to the theoretical deductions from the vast frequency of such plants in our Oolitic formation as *Solenites*, congeneric or almost identical with *Isoëtes*, and as *Pilularia*, both existing not merely in wet marshy ground, but actually in water itself, what can we infer, but that the whole of the district wherein they now occur, was a morass deeply covered in many places with water; and that *fresh* water, in which such plants grew and floated, and which along with the *Lycopodia*, and *Ferns*, some larger and arborescent, others humble and delicate, were all suddenly overwhelmed by an irruption of the ocean, when the saline impregnation soon would destroy vegetable life in such plants, and the sedimentary deposits through a long series of ages, would gradually produce the slaty clay, and granular sandstone now enclosing those beautiful and interesting remains.

“Assuredly fire could not have been the agent of transmutation, because both resin and tannin have been detected still existing in the scarcely mineralized leaves of the *Solenites*, and of one or

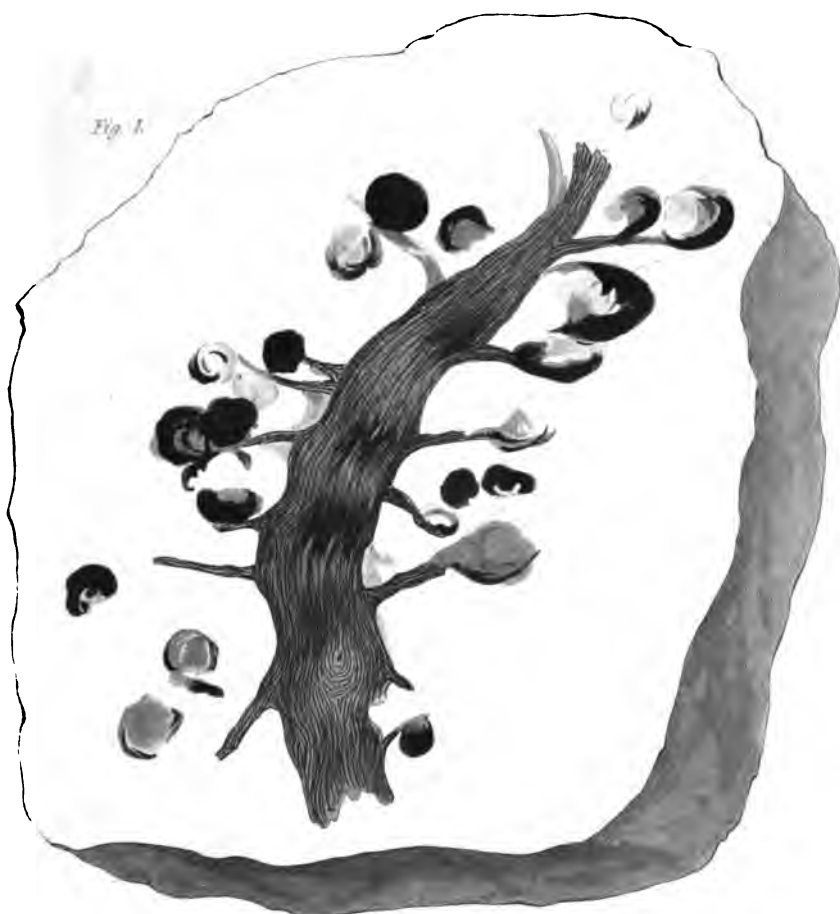
two species of Cyclopteris, and such vegetable principles, though not changed by the action of water, must have been decomposed by intense heat, or any combustion."

Thus far Dr. Murray concerning this remarkable production, upon which we are really unable to offer any opinion. We have inspected the specimens through the liberality of Dr. Murray; but they throw no light upon their original nature so far as we can discover.

Mr. Williamson, Jun., writes concerning the plant as follows.

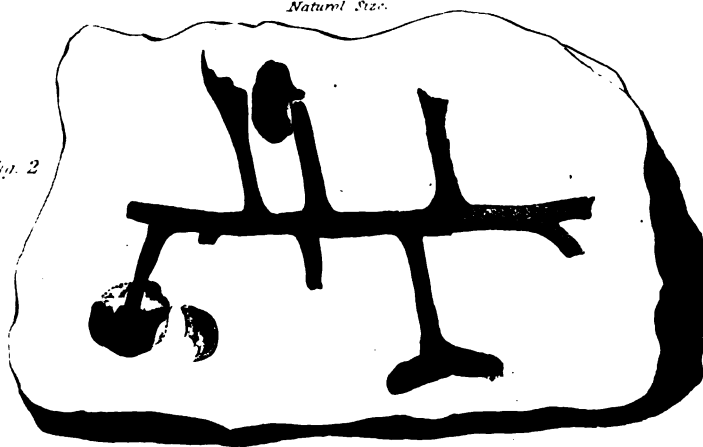
"It is very coarsely and irregularly striated, and the curious lateral appendages branch off without any apparent uniformity of direction. With them, but separate and detached, are found many singular berry-like substances, and the question is, have they any connection with the plant. The stems of the smaller specimens are striated, but more finely, and the lateral branches appear to have been terminated by a kind of round or oval leaf, which is now one homogeneous mass of carbon without the least appearance of any regular veins or striæ either in the stems or leaves. The carbon is excessively thick, instead of being in thin laminæ as in most vegetable impressions."

Fig. 1.



Natural Size.

Fig. 2.





Magnif.!

SPHENOPTERIS CRASSA.

From the Limestone of Burdiehouse.

We know no modern Fern in which so great a disproportion exists between the pinnules and rachis as in this very curious plant. There is also the remarkable circumstance connected with it of one of the pinnules being very short and others much longer.

The general form of the latter appears to have been nearly round, with three or more deep lobes, and a somewhat doubly crenelled margin. We find, however, no regularity in the form of the pinnules nor in their size.

The stem is remarkably speckled, but whether this arises from original markings, or from minute fractures of the carbonaceous coating of the surface we are uncertain.

We have seen no trace of this species in any other rock than that of Burdiehouse.

NOTE UPON THE BURDIEHOUSE FORMATION.

BY MR. HUTTON.

In the present number we figure two more Fossils from that remarkable deposit of the remains of the Vegetable and Animal kingdoms, that occurs at Burdiehouse near Edinburgh. In the year 1831, we first visited the quarries in company with our excellent friend, Mr. Witham, in whose collection we had observed some very fine specimens from this locality, two of which are figured at plates 45 and 53, of this work, which were the first of the Fossils from Burdiehouse that were published.

It had been our intention to devote one entire portion of the Fossil Flora, to the elucidation of the Fossils of this locality, and we were aware that through our observant friends, every new plant found would be made known to us, but the variety of the species occurring, bears no comparison to the number of remains; and, notwithstanding the liberality of the Royal Society of Edinburgh, who, through the kindness of their Secretary, John Robison, Esq., placed the whole of their collection at our disposal, and also that of Dr. Hibbert, who was kind enough to lend specimens of all he thought

peculiar, we are yet unable to make out satisfactorily more than a very few species.

The Fossils of Burdiehouse occur in a bed of Limestone 27 feet thick, remarkably compact, uncrystalline, and uniform throughout; the Geological position of this Limestone, is low down, probably very near the base of the Carboniferous group of rocks, it is highly inclined, dipping with its immediately associated beds, at an angle of 23° in a S.E. direction, from the Trap of the Pentland Hills, the protrusion of which has evidently thrown them into the position they now hold.

The vegetable remains occur in great profusion, and are to be found in every part of the Limestone from top to bottom, and also, but more sparingly, in the Shale beds, above and below it. There are certain well defined natural partings, or seams of stratification in the rock, which as they materially assist the working of the quarry, often expose an even surface of considerable extent, in these partings the remains of plants occur in greater abundance than any where else.

When we last visited the quarry (May 1835,) a large space was thus uncovered, which was thickly strewn over with elegant vegetable forms most perfectly preserved, the black colour of the carbonized plants, contrasting beautifully with the light lavender blue of the Limestone.—Some idea may be formed of the profusion of the remains thus exhibited, when we state that in a space of 3 feet

square, we counted upwards of 40 specimens of *Lepidostrobi*, intermixed with *Lepidophyllites* almost without number, whilst scattered here and there might be observed the elegant form of *Sphenopteris affinis*; so agreeable was the impression produced by the elegance of the forms, and the sober contrast of colour in the stone, that it struck us, the calico printer or paper-stainer might here obtain a beautiful and certainly a novel device, for the ornament of his manufacture.

As before observed, vegetable remains occur every where throughout the Limestone, and their greater profusion in the natural partings of the rock, may be accounted for by supposing these to indicate (as they no doubt do) a period of repose—a short cessation of the calcareous deposit, whilst the parts of plants were constantly falling or being washed into the lake. There are doubtless many discoveries yet to make of vegetable forms entombed in this interesting spot, but perhaps it is somewhat unfortunate for our branch of the subject, that the brilliancy of the discoveries in Fossil Zoology, as well as the beauty and variety of the remains of animals which occur, have directed too exclusive an attention to that department. Whilst the animal remains are sought for with avidity those of plants go to the limekiln by hundreds.

Amongst vegetables the characteristic Fossils of this deposit are *Lepidostrobi*, *Lepidophyllites*, *Lepidodendra*, and *Filicites*; the rarity of *Calamites*

which occur but seldom, and of a diminutive size, and the almost entire absence of *Stigmaria*, are very striking, to those who are accustomed to view the Fossil groups usually presented by the beds of the Carboniferous formation; whilst the profusion of *Lepidostrobi* and *Lepidophyllites* of various sizes and in various states of growth, associated with the stems of *Lepidodendra* and those of no other plant, is an additional argument for the opinion, which has always appeared highly probable, that they are the fruit, leaves, and stem, of the same tribe of plants. Of *Sigillaria*, a plant which in the Flora of the Carboniferous group, generally is of so much importance, we could not observe a trace. No stems of *Lepidodendra*, equal in magnitude to the larger individuals found in the Coal strata and other beds of the Carboniferous deposit, have yet been observed here; short portions of those of a smaller size, are met with frequently, but these are invariably turned into coal, and have lost a good deal of character, by the indistinctness of their outward form. It struck us as rather a singular circumstance, that whilst cones and leaves, and even the delicate organization of Ferns, were completely preserved, the majority of these robust stems had so little of their strongly marked character remaining. Mere carbonization does not always destroy the outward form of Fossils, and if it had in the instance of these stems, we should have expected to have found their

impressions upon the Limestone matrix, as it occurs upon the Shales, and even the rough grained Sandstones, of the Coal measures. May we not suppose these to have been portions of stems (for they are mere unconnected fragments) decorticated by age and exposure, before they were deposited here? The smaller stems of *Lepidodendra* not unfrequently are found intimately associated with *Lepidostrobi*, and in some instances the cone and stem are seen in actual contact, but never in such a way as to point out with any thing like certainty, that they were parts of the same plant; perhaps, even as a collateral proof, the mere circumstance of this intimate association is not of much value, as from the abundance of *Lepidostrobi*, we ought to find them in connection with every other Fossil in the deposit;—from their abundance, however, in a detached state, we may fairly infer that these cone-like bodies were easily disarticulated.

Although the vegetable remains enclosed in this bed are fragments only, yet from their size and character there is every reason to believe they have belonged to old and full grown plants, whilst from the perfect state of preservation in which the most delicate of them occur, we must suppose that the plants themselves grew in the immediate neighbourhood of the lake, and on the banks of the streams that fed it, into which portions of them were constantly falling, or that partial floods covering the land, carried off the lighter

parts only, from amongst the larger stems, and deposited them where we now find their remains.

One of the many remarkable circumstances attending this bed of Limestone is, that all its organic remains proclaim it to have been produced in fresh water; in this it differs from the characters of the Calcareous beds of the Carboniferous formation generally.

Dr. Hibbert has in a luminous Memoir which he communicated to the Royal Society of Edinburgh, and which is published in their Transactions (vol. 13.), fully established the fresh water character of the Limestone of Burdiehouse, and it is to his scientific zeal, which was ably seconded by that of Mr. Robison, that we are indebted for a complete knowledge of the organic contents of this most curious deposit. To the Royal Society of Edinburgh also, as a body, the scientific world are deeply indebted, they having promptly stepped forward, at the suggestion of Dr. Hibbert, and with a power which could be commanded by no individual, rescued the Fossils from destruction and dispersion, preserving to themselves one entire set, which they most liberally lay open to all those who feel an interest in them.

The Burdiehouse bed, after a considerable interval filled with alternations of Sandstone, Shale, and Coal, is succeeded by another thick stratum of Limestone, having the usual characters of those of this formation, all its Fossils being of marine ori-

gin. We should not be surprised to find this much more generally the case than is at present supposed, as many of the Coal, Shale, and Sandstone beds, with which Limestone is associated, and which form by far the larger portion of the Carboniferous group, bear undoubted marks of their origin in fresh water. Dr. Hibbert mentions several beds of Limestone near Edinburgh, besides that of Burdiehouse, which possess this character. Mr. Murchison, also, describes one as occurring in the Coal-field near Shrewsbury, and we have ourselves had occasion to observe a belt of Limestone, almost of the same age and geological position, as the Burdiehouse bed, which is worked along with a thin seam of coal, on the tops of the hills, west and south-west of Wooler in Northumberland ; where the remains of *Lepidodendra* and *Stigmaria* are associated with those of the *Cypris*, and its allied genera of *Entomostraca*.

These alternations of salt and fresh water deposits, which are so well known in the newer formations, have led to the idea of a series of oscillatory movements, by which the surface of the earth, during the deposition of the strata, was alternately brought within the influence of the ocean and fresh water.

It has been demonstrated that very large portions of the Earth's surface have been thrust up far above the level at which they were produced, and there are many reasons for supposing that this was a gradual and not a sudden operation.

In the splendid theory of Mons. E. de Beaumont, this forcing up is supposed to have arisen, from the endeavours made by the outer cooled crust of the earth, to adjust itself to the interior mass, which was constantly losing bulk, in its passage from a state of igneous fluidity, to one of hardness—cracks being formed through which chains of mountains were protruded. Now supposing this, or any thing analogous to it, to have taken place, the gravitation of the large masses of hardened matter, between these lines of fissure or elevation, would form hollows, which would gradually deepen as the mountains rose.

If the depression of surface was great enough to bring it within the operation of the sea, and no barrier intervened, then would deposits be formed containing marine remains, layer upon layer, differing in nature according as the silicious, aluminous, or calcareous matter predominated in the waters. This would continue until the surface was so far raised as to shut out the sea, then fresh-water deposits would succeed, differing in their character, according to the nature of the detritus brought down by the operation of floods—until at length there was a surface partially dry, fitted for the growth of vegetables; these, from the abundance of moisture, and the high degree of temperature existing, would grow rapidly and to a large size, until, by successive growth and decay, their remains formed a thick layer—a sort of peat-bog—

which, in its turn, by gradual depression, might be succeeded by a layer of mud or sand, being thus sealed up, to become in after ages a bed of coal. Marine productions would not again be present in the deposit, until the depression was deep enough to bring the basin below the level of the sea; but as the supply of detritus would be from the land, the constant accumulation of this would again shut out the sea; and in this way alternations of strata, characterised by the presence of marine and fresh water remains, might occur precisely as we observe to be the fact in nature. Nay we ought not to be surprised, if we were to find in the same bed, alternate layers of fluviatile and marine exuviae; it is only to suppose, that the sea was shut out whilst a thick bed was being deposited, by which we might have marine remains at the bottom, and those of fresh water at the top, with a mixture of both between; or the fossil characters of the bed may be reversed, if we suppose the great depression which brought in the sea, to have taken place whilst a thick stratum was in the act of deposition.

It further appears to us that this view of the mode of formation of our Fossiliferous rocks, is borne out by the nature and condition of their organic remains—the whole of which, animal as well as vegetable, we think, prove that the beds containing them have been formed in water of a moderate depth, and as it is abundantly established that there are alternations of marine and fluviatile

beds, even in deep-seated strata, we must either account for these, by a system of depression, such as we have been advocating—by which each bed was deposited so near the surface, as not to be unfavourable to the existence of animal life—or call to our aid the theory of oscillation ; as we imagine few Geologists will be found at the present day, to advocate the old notion that the organic remains in these alternating beds of such differing natures, had all been precipitated to the bottom of the same ocean. To any one who may be found entertaining such a notion as that the carboniferous group of rocks of the counties of Northumberland and Durham, for instance, were formed in a deep basin, we would observe, that it is one whole unbroken series of strata, certainly not less than 4 to 5000 feet thick.—Is it possible to suppose that the Corals, the Crinoidea, and various Testaceous Mollusca—the remains of which we find in the deepest seated Limestone and Shale beds in profusion, could exist at so profound a depth?—or can we suppose the Vegetables,—*Stigmaria*, *Sigillaria*, &c. whose remains exist in some of the lowest Sandstone beds, alternating with these same Limestones, and which beds do not contain a vestige of marine life, could have found their way to the depths of such an ocean, without mixing with the remains of animals which existed in it in abundance? or, could portions of the most delicate Ferns, which, in point of preservation, rival the skill of the most accomplished

botanical preserver, and which we find in almost the very lowest of our secondary formations, have found their way to such a situation uninjured?

The great north of England Coal-field contains 25 seams of coal, alternating with beds of Shale and Sandstone, forming altogether a thickness of 8 to 900 feet—is it possible to suppose the vegetable matter, which constituted these coal seams, to have been washed by floods from the land, and sunk to so profound a depth; every layer persistent over the whole space, and of an even thickness?—or supposing such sinking to have been possible, could the vegetable matter be free from any foreign admixture as we find the coal to be?

It is the opinion of Geologists, that most of the Saurian animals whose remains have been discovered, inhabited shallow water, in the immediate neighbourhood of land upon which they occasionally lived—as the animals nearest allied to them in nature now do—and it is known to be the general character of living testaceous Mollusca, to inhabit shoals of moderate depth, round coasts, rather than the deep sea;—this being the case, it is not unfair to suppose their ancient prototypes to have had like habits. We are aware that it is even yet supposed that the originals of all the organic remains we find have been shifted and washed about in the water,—drifted in fact far away from the spots where they lived. We have elsewhere in this work given reasons, which to our minds are conclusive,

why this could not have been with vegetables ;—the remains of animals of one species occurring so commonly in the carboniferous formation, where their shells are found congregated together in thousands, of all ages and sizes, we think attest the same fact :—but in the Limestone of Burdiehouse the organic remains prove incontestably, that this was the case, for we not only have them of different sizes and ages, some perfect (as many of the smaller fish, retaining every scale,) but in the fæcal matter which is found abundantly disseminated throughout the whole bed, and from the examination of which we gain such a curious insight into the habits and economy of these animals, and which would be of a nature incapable of being moved without dispersion, we are incontestably led to the conclusion, that these animals lived and died in waters and near the spots where their remains now exist.

Along with Coprolites, we find in the utmost profusion, so as even in some parts to make the rock appear almost Oolitic, the shells of Cypris, with other minute Entomostraca, whose habitat is one of stagnant waters ;—upon these undoubtedly the smaller fish had fed, as their existing representatives now do—they, in their turn, becoming the prey of the larger kinds.

Were any other arguments necessary to convince us that the deposition of even our deepest seated Fossiliferous beds, had taken place in compara-

tively shallow water, the Ripple marks so common upon them, which many Geologists think are proofs of a deposit at or near the edge, of comparatively tranquil water; and the oblique bedding of Sandstones, which is taken to indicate the quiet deposit of sand, in thin layers, over lines of surface differing from those of stratification, would furnish us with additional evidence. Both these phenomena occur in many beds, even to the very lowest, in the carboniferous formation.

The basin-shaped depressions we have been considering, would appear to offer the conditions which have, *a priori*, been thought to be necessary, to account for the tranquil deposit of most vegetable remains, but particularly those so frequently found in the carboniferous series to stand vertically across the strata;—for whether we consider these to have been drifted from their places of growth, and to have settled with their root ends down, or that the Fossils now occupy the spot on which the plants grew, as we believe many of them do, we equally require a quiet deposit, in a situation removed from the destructive action of large masses of water in motion.

This view of gradual depression recommends itself further to our minds by its simplicity. It is difficult to conceive, in the series of strata we have had under review, that after the deposit of the Burdiehouse system, a sudden sinking of surface should take place, to receive the marine Limestone

of Gilmerton, which succeeds it in the section—this to be as suddenly brought up to be covered by the alternating Coal series of Loanhead. Difficult as this is to understand, it is however a simple problem, compared to the numerous sinkings and risings that would be necessary to account for the many and sudden alternations of salt and fresh water remains, which occur in the newer Fossiliferous rocks; all which oscillations have taken place without leaving evidence of any peculiar disturbance in the strata supposed to indicate these movements; indeed so quiet must they have been, as not even to disturb the plane of stratification, or alter the chemical nature of the deposit, that was going on when the change took place.

LEPIDODENDRON LONGIFOLIUM.

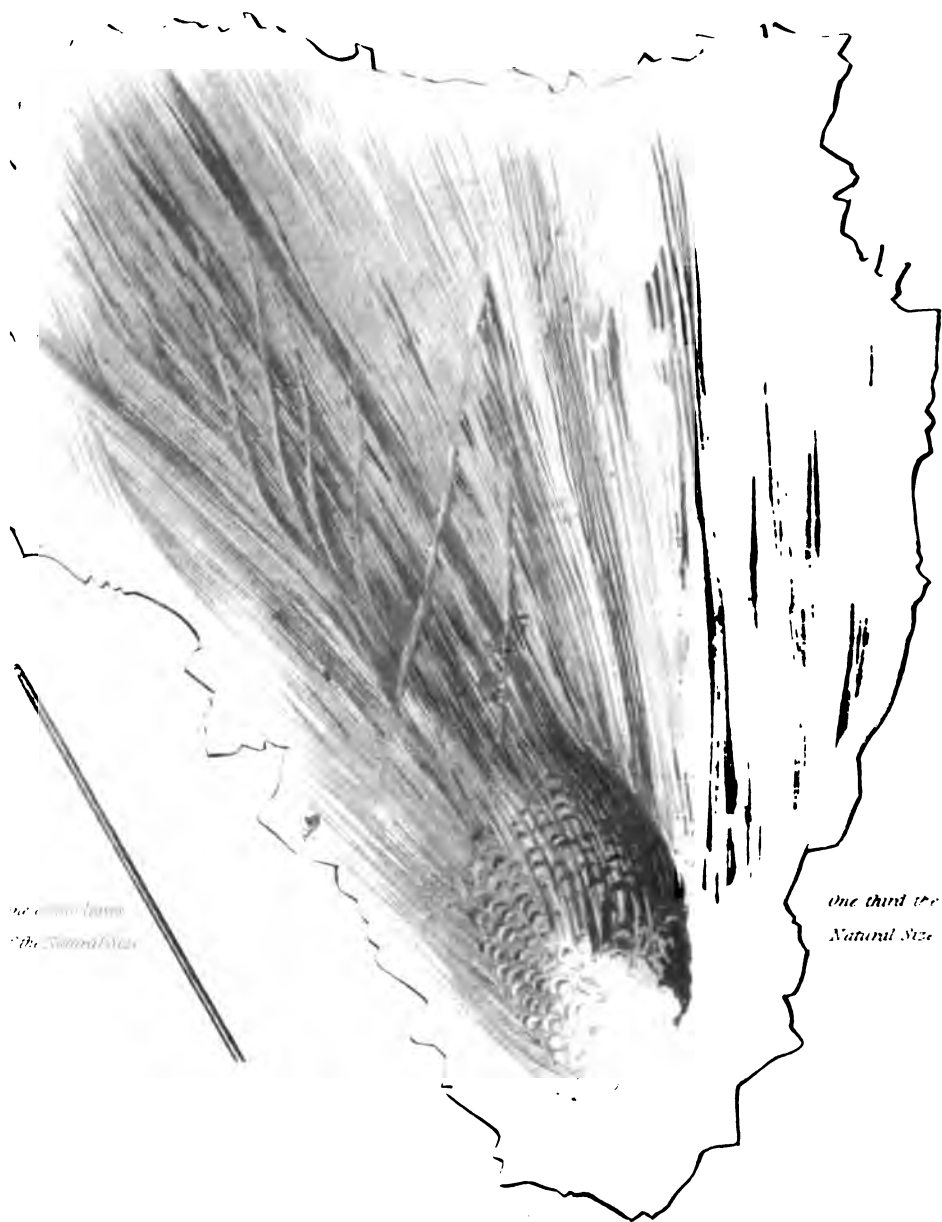
Lepidodendron longifolium. *Ad. Brongn. Prodr. p. 88.—*
Sternb. Flor. du monde primitif. t. 3.

From the Newcastle coal measures.

Although this is not to be compared with the beautiful specimen figured by Count Sternberg, which was $2\frac{1}{2}$ feet long, with leaves 18 inches in length, yet it is interesting as shewing this remarkable plant in a new state. In Count Sternberg's specimen the branch was nearly cylindrical and very slender, but here it is more thick and compressed, as if it had been distending into a cone, or something of the sort.

In its general aspect it resembles very much *Pinus palustris* or *longifolia*, but it appears to have

had its leaves growing solitary and not in pairs and clusters, and therefore could not even have belonged to the genus *Pinus*. In all probability it was another form of that extinct race which held a middle place between *Lycopodiaceæ* and Coniferous plants, as we have already explained. See *t.* 98 and 99.



Pub. by Messrs. L. & C. W. L. on 10th July 1835

LEPIDOSTROBUS COMOSUS.



From the Burdiehouse limestone.

Apparently a distinct species of this genus, differing from the other published kinds in its much larger size, in its conical figure, and in the very shaggy appearance of its outside. It is impossible to say positively what it is that has produced this appearance, but it is probable that it is owing to the great length of the points of the scales of which such cones consisted.

Drawn from a specimen belonging to the Royal Society of Edinburgh.

LEPIDOSTROBUS ORNATUS; var. *didymus*.

See tab. 26.

The beautiful specimens from which this drawing has been taken were communicated to us through Professor Graham by Lord Greenock, who found them in the Ironstone at Newhaven, near Edinburgh.

They are an instance of apparent malformation, in consequence of two cones having grown together, but they do not throw any more light upon the real structure of *Lepidostrobus* than has already been given at t. 26 of this work. They are, however, so extremely beautiful, in consequence of the

skilful manner in which they have been polished, that we gladly seize an opportunity of making them known.

It would seem as if a Palm leaf had been pressed over the outside of the cone at fig. 1.



From the Middle Devonian, Canada, July 1896.



PINUS ANTHRACINA.

From a single specimen found in the Coal measures of Newcastle by Mr. Buddle this figure has been taken. It is too imperfect to enable us to form any other opinion concerning it, than that it was the cone of a Fir, which in all probability, belonged to the modern genus *Pinus*, if we are to judge from the great thickness of its scales.

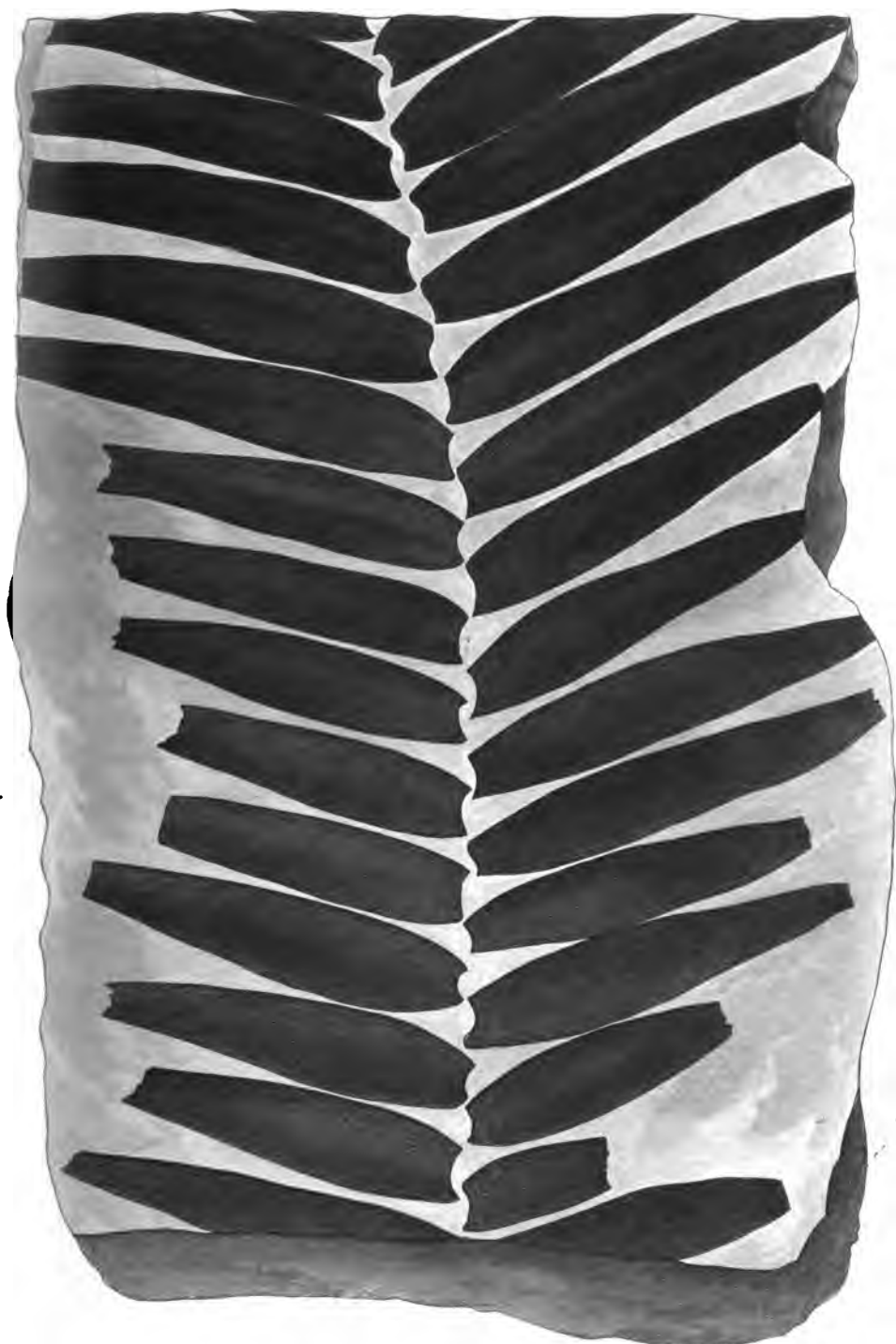
We know no modern species with which it would be of any use to compare it.

ZAMIA GIGAS.

One of the largest of this genus found in the Oolitic rocks of Scarborough. It has occurred as much as three feet in length. Mr. Williamson, Jun., whose drawing we use, informs us that its leaflets are sharp pointed, with regular veins which are simple, and, like those of most monocotyledons, terminate at the narrow apex, though some of them have formed little points on the margin of the leaflets. The latter circumstance may be considered to indicate the commencement of lateral teeth, and if so the identity of this and similar remains with modern *Zamias* will be more strongly than ever demonstrated; because *Zamia* is the only modern Cycadeous genus known in which the leaflets have lateral points.

If it were not for the manner in which the veins are distributed, we should have supposed this to

be the same as the *Cycadites latifolius*, figured by Professor Philips at t. x. f. 3, of his second edition of the Geology of the Yorkshire Coast. But in that plant the veins are represented as losing themselves in the margin along the whole of the upper edge of the leaflets, and not terminating in almost all cases in the apex.



T. Williamson, del.

Printed by Messrs. Ridgway, London, July 1876.

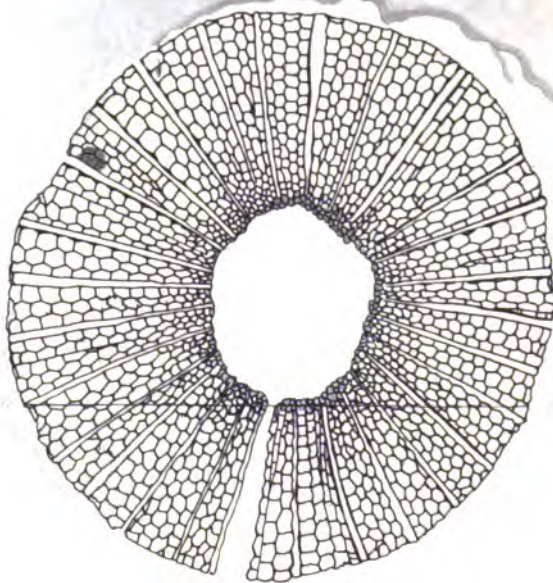


Fig. 1.

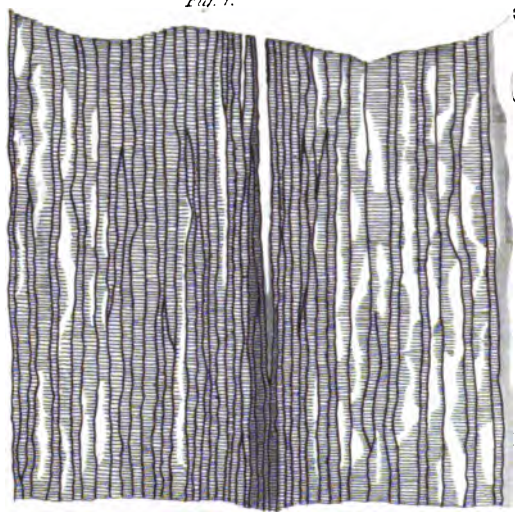


Fig. 2.

STIGMARIA FICOIDES.

(Its Anatomy.)

See tab. 31 to 36.

We have so frequently referred to this extraordinary fossil already, and have so continually insisted upon the impossibility of forming any opinion of what it really was, that we have peculiar satisfaction in being able at last to prove the correctness of our supposition, that it was in reality a plant of which no modern analogue exists, by its anatomy. For this we are indebted to our friend Mr. Prestwich, who placed in our hands some time since a fragment of *Stigmaria*, preserved in Ironstone from Colebrooke dale, which seemed to promise some preservation of tissue. Upon being polished by Mr. Cuttell, an ingenious London lapidary, and a worthy rival of Mr. Sanderson of Edinburgh, it presented the appearances here represented.

The transverse section exhibited a meshing something like that of *Coniferæ*, but with no con-

centric circles, and with the medullary rays consisting rather of open spaces between the other tissue, than of the common muriform tissue found in such places. The longitudinal section (*fig. 2.*) presented an assemblage of spiral vessels, of a very tortuous and unequal figure, without any woody or cellular matter intermixed.

These formed a cylinder which was surrounded externally by a mass of inorganic mineral matter, upon whose surface the peculiar markings of *Stigmaria* were preserved, and which enclosed a hollow cavity altogether destitute of mineral deposit.

It would therefore appear that *Stigmaria* was a plant with a very thick cellular coating or bark, surrounding a hollow cylinder, composed exclusively of spiral vessels, and containing a rather thick pith; and that the plates of cellular tissue which preserved the communication between the bark and the pith were of so delicate an organization, that they disappeared under the mineralizing process which fixed the organic characters of the wood.

It is almost needless to say that no plants of the present day have such a structure, and that consequently our original impression that *Stigmaria* represents an altogether extinct race was correct.

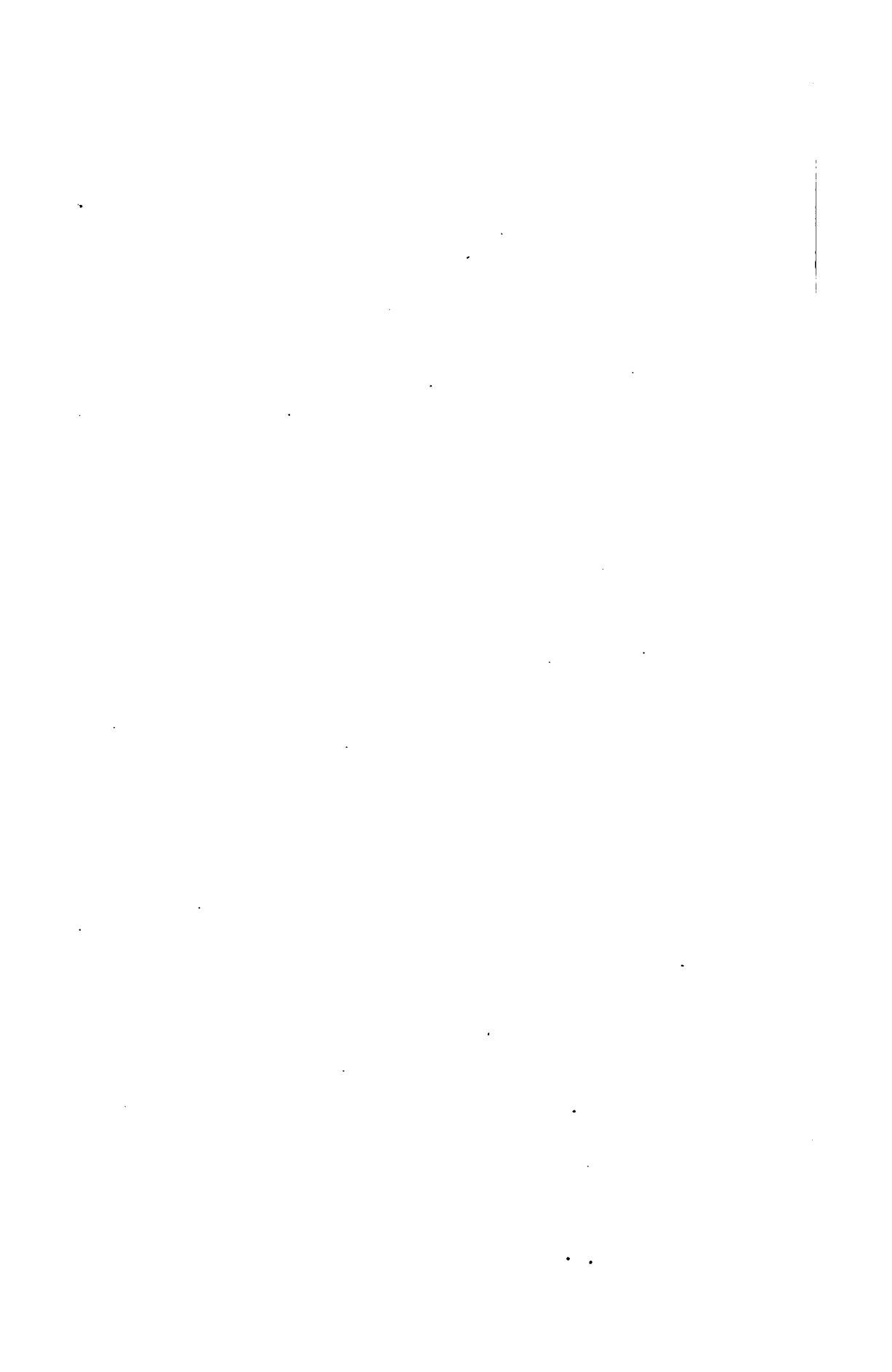
We must, however, remark that we strongly suspect our *Caulopteris gracilis*, (t. 141.) to be the same thing, as well as Mr. Witham's *Anabathra pulcherrima*.

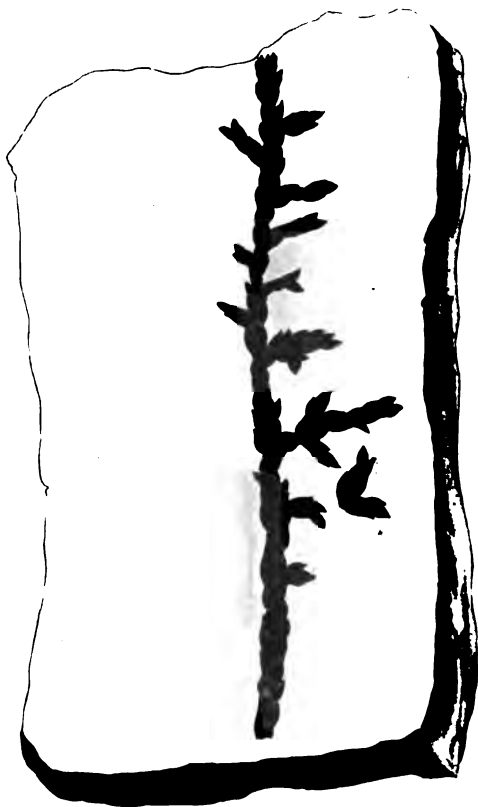
THUITES EXPANSUS.

Thuites expansus. *Sternb. Fl. der Vorw. Fasc. iii. p. 39.*
t. 38. f. 1, & 2. Phillips Geol. Yorks. t. 10, f. 11.

From the lower Sandstone shale and coal of the Oolitic beds near Scarborough.

Mr. Williamson, Jun., remarks that this plant, "in its general form and mode of branching, bears a considerable resemblance to *Lycopodites Williamsonis*, but differs from that plant in the scales being shorter, broader, and more flattened, and also in the absence of stipules. It is seldom found large:





Magnified.



Magnified.

SPHENOPTERIS ARGUTA.

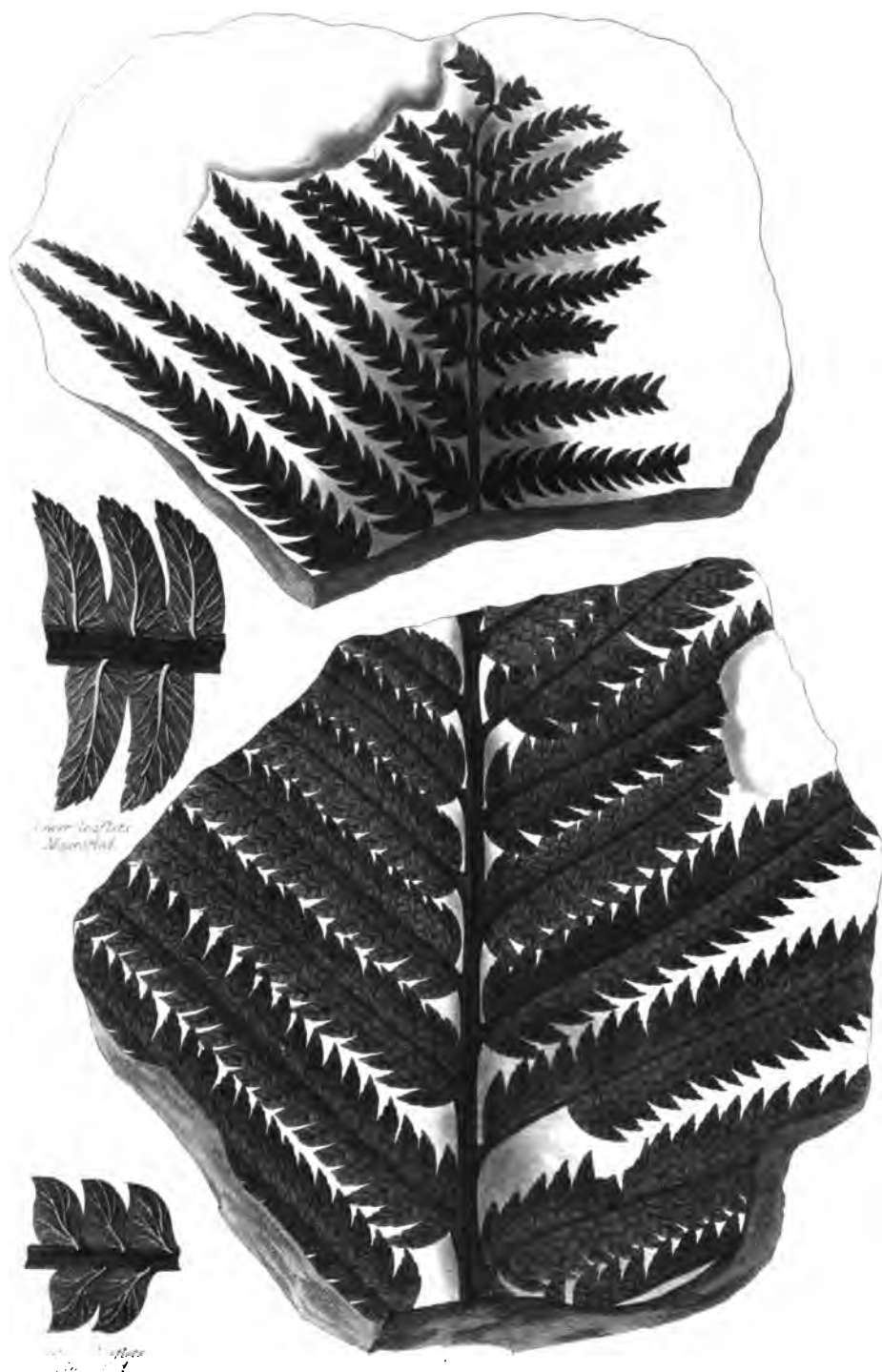
From the Oolitic rocks of Scarborough. Supplied by Mr. Williamson, Jun., with the following note.

"A bipinnated frond of small size, but of remarkable elegance. The central rib is prominent but bears no marks of any angles. The leaflets are rhomboidal, the lower ones with from 5 to 9 lobes, which are generally split at their ends, the lobe at the base of each leaflet being generally the largest. The veins are very indistinct, but certainly forked, one branch entering each lobe. Towards the apex of the frond the leaflets are very small, but once or twice lobed, and that on the upper edge only. In the lower leaflets the lobes are almost always opposite, and the connecting portion between each pair but little more than the diameter of the central rib. We have no species of *Sphenopteris* with which this can be compared. It is decidedly different from *Sph. stipata*, as well as *Sph. hymenophylloides*, the latter of which in particular has shallower lobes to the frond."

the plant is the extreme strength and distinctness of the nerves, which in some specimens are of a deep black, whilst the other parts of the leaflets present the rich brown of the autumnal leaf. The leaflets near the apex are much shorter in proportion to their width, and of a more falcate form. The central nerve, instead of springing from the centre, rises from the posterior portion of the base of each leaflet, and the nervures are fewer in number, and but simply furcate.

“The only plants with which this can be compared are *Pecopteris Whitbiensis*, *hastata*, *ligata* and *denticulata*; from the three former it differs in the denticulated apex, and from the latter in its much smaller size, which varies but little, (and I have fifty specimens of it at least,) in the greater strength of the nerves, and in the different arrangement of the basal ones.”



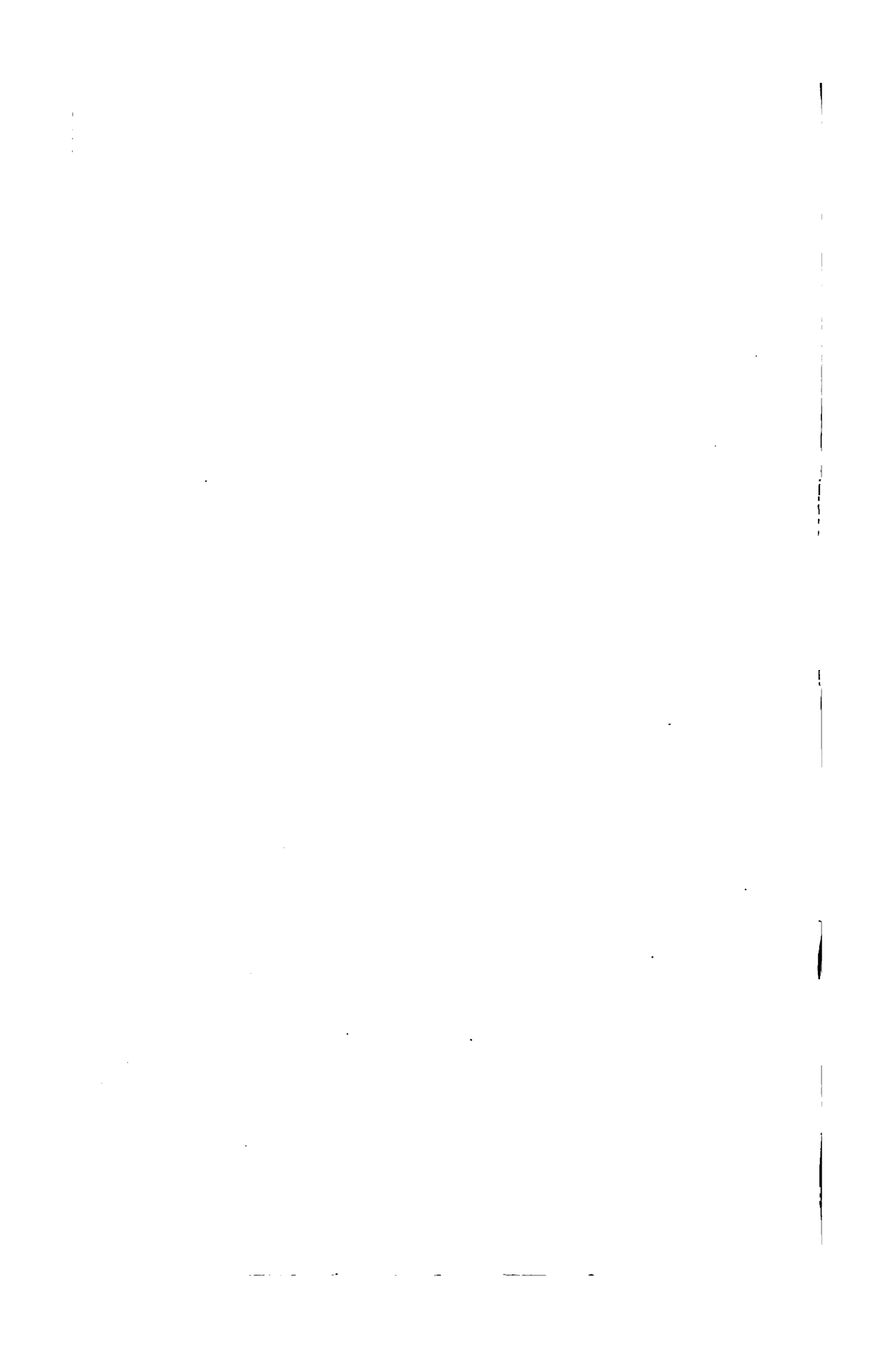




Magnified.



Magnified.



TYMPANOPHORA SIMPLEX.

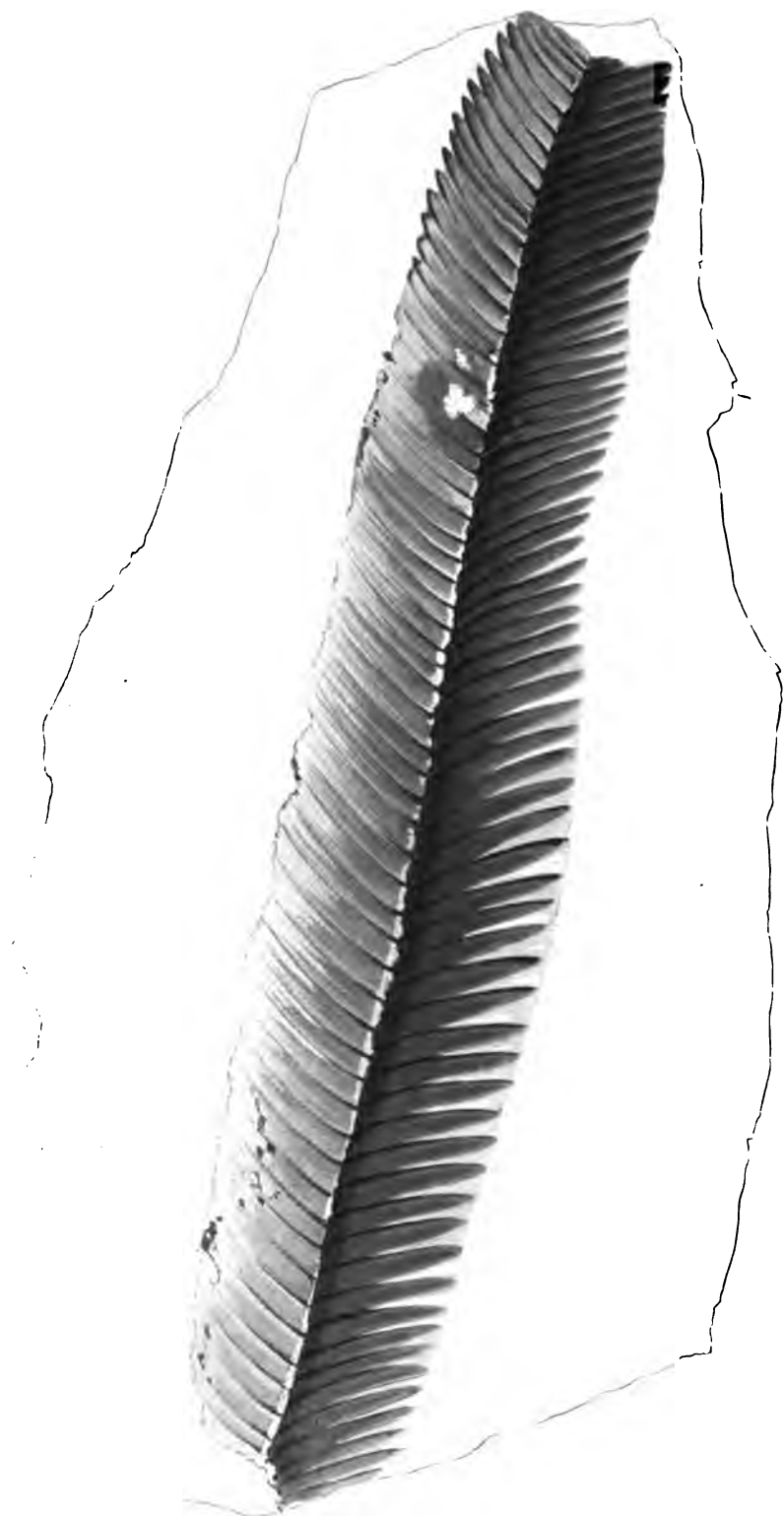
From the lower shale of the Oolitic rocks at Cloughton Wyke near Scarborough; Mr. Williamson, Jun., to whom we are indebted for our drawing, speaks of the specimens thus:

"It has a narrow straight stem of equal thickness, with a faint linear impression along its surface. Small slightly curved stalks shoot irregularly but alternately from either side; their surfaces present an indistinct nerve, which branches on arriving at the globular appendage, with which each pedicel is terminated. These are probably seed-vessels, as they are very prominent, and apparently have been globular. Their convexity does not commence immediately at their junction with the footstalk, but a little beyond it, which will be best understood by the magnified figure. Near the base of the seed-vessels, and arising from the stalk, springs a bract, which sometimes reaches beyond the seed-vessel."

in length. It had an exceedingly strong midrib, as is proved by a deep furrow left in the sandstone. This is all the specimen shews.

That it ever was a Fern there is no evidence in this specimen ; but from others it appears to have had all its secondary veins *reticulated*, a character which is now met with among ferns in the genera *Lonchitis*, *Woodwardia*, &c. What this specimen is most valuable for, is, the accurate view it gives of the original form of the whole leaf, of which fragments only had been previously represented.





Tab. 18. Algae? Rudway, London, 1874.

ZAMIA PECTINATA.

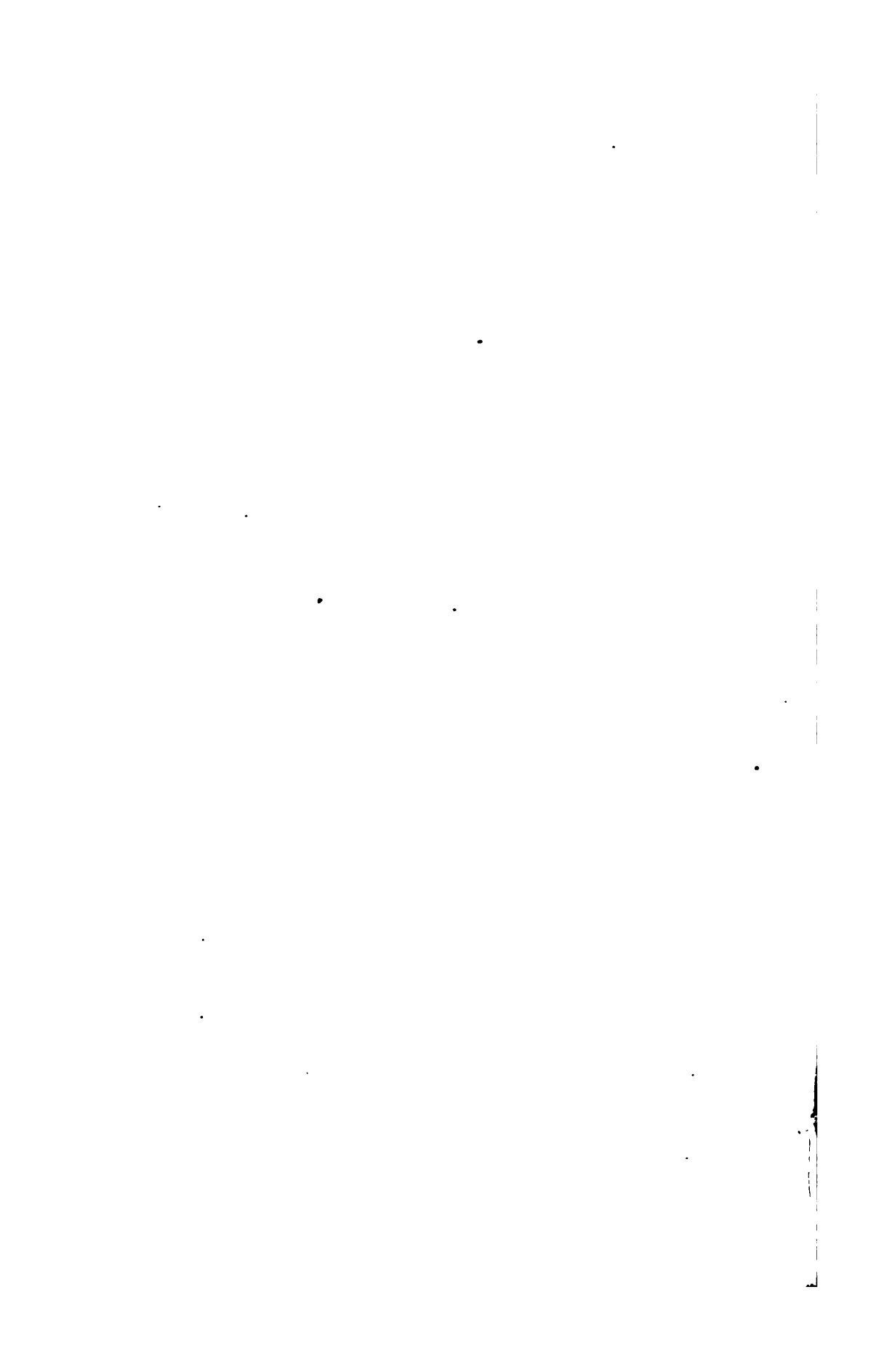
Polypodiolites pectiniformis. *Sternb. Fl. der Vorw. Fasc. iii.*
p. 39. t. 33. f. 1.

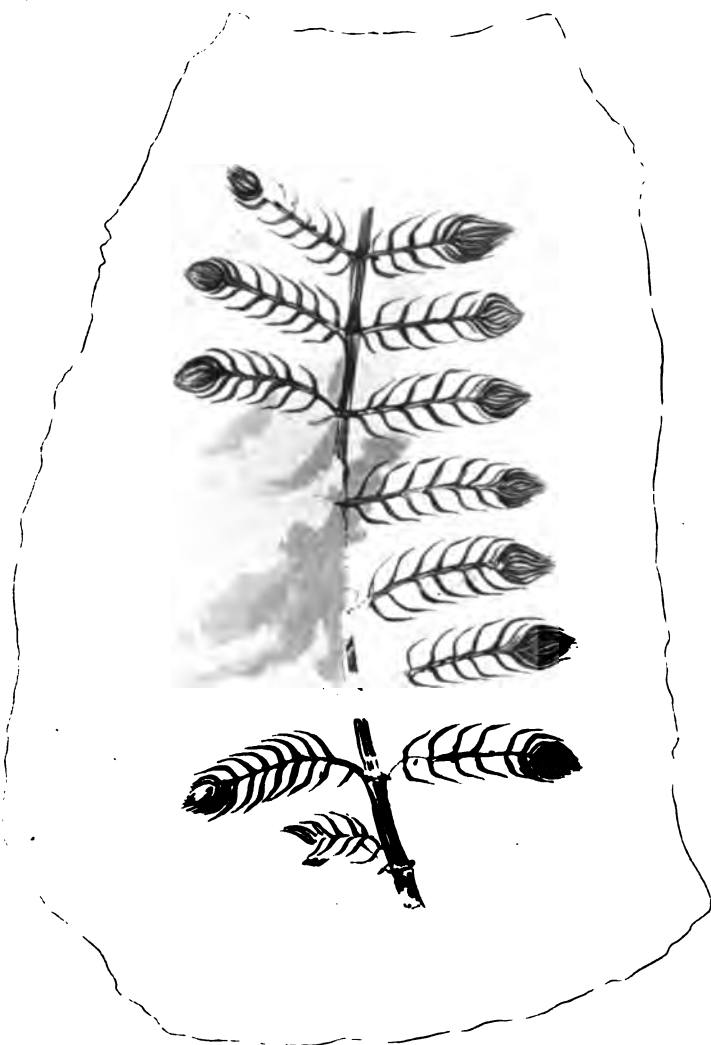
Zamia pectinata. Ad. Brongn. Prodr. p. 94.

Communicated from the Stonesfield slate* by
Professor Buckland.

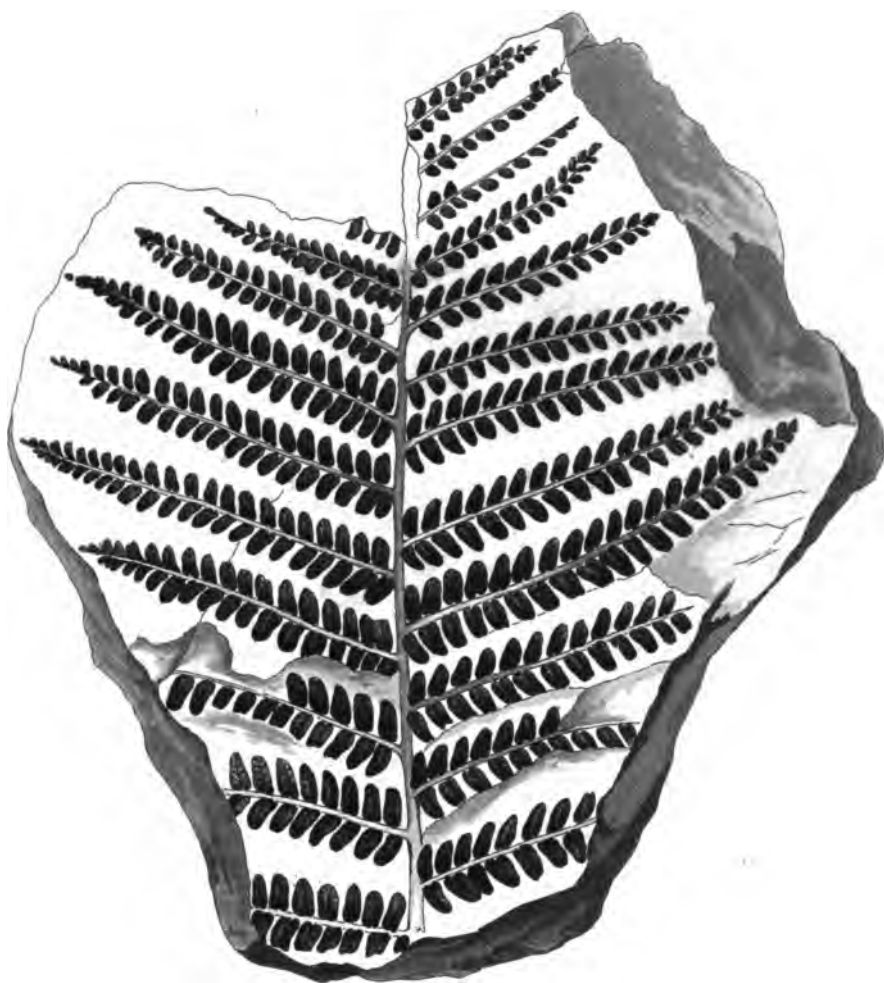
The specimen was very perfect, measuring nine inches in length, and shewing the outline of the segments of the leaf distinctly even up to their points, which were evidently rather suddenly sharpened off. It appears very distinct from any of the fossil remains that have been elsewhere discovered.

* Geologists are probably aware that Mr. Lonsdale has ascertained the Stonesfield slate to be under the Bath or great Oolite, and at the top of the inferior Oolite.





Frond of *Adiantum latifolium* (L.) Sw.



Magnifolia

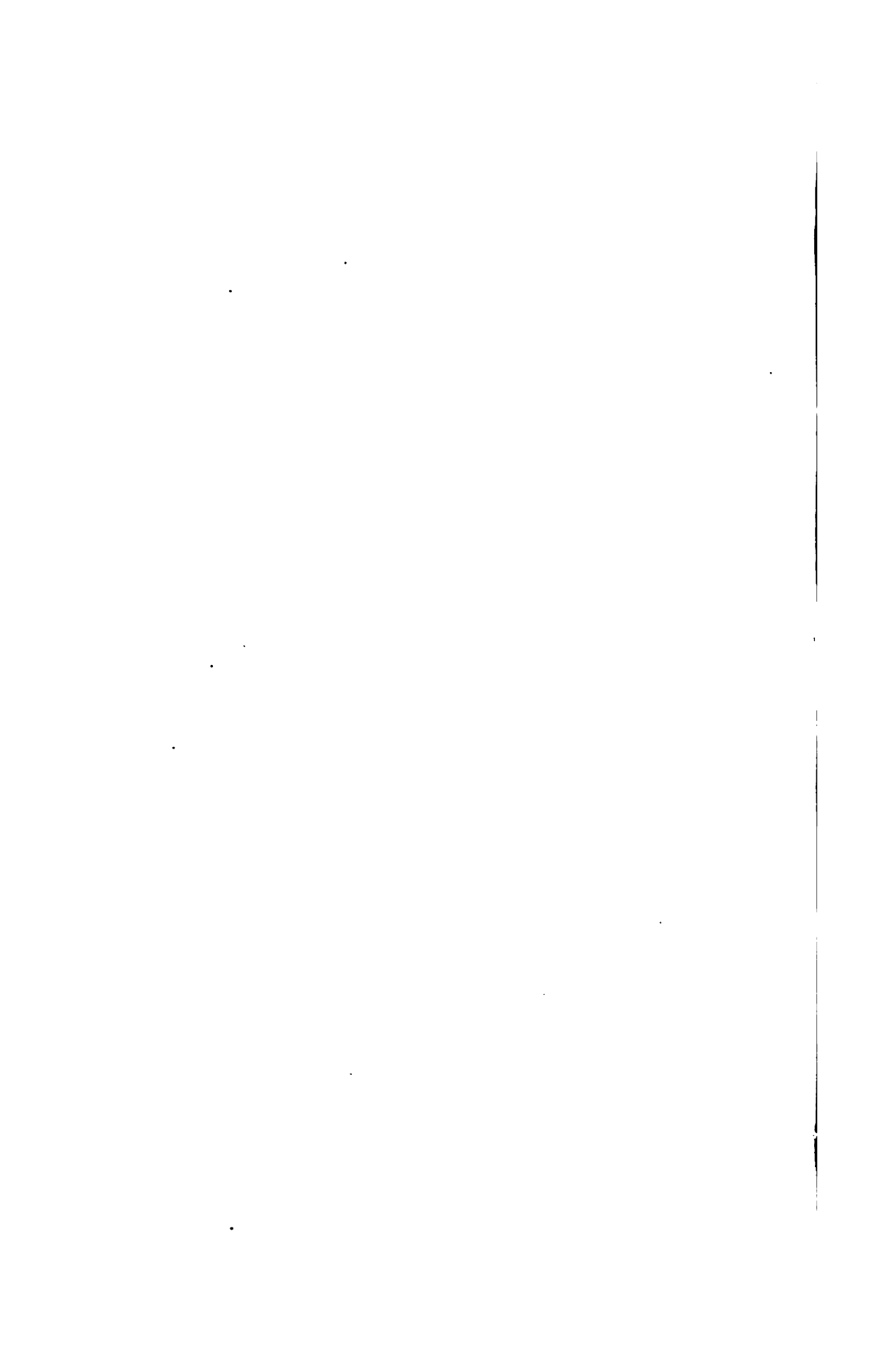
NEUROPTERIS ATTENUATA.

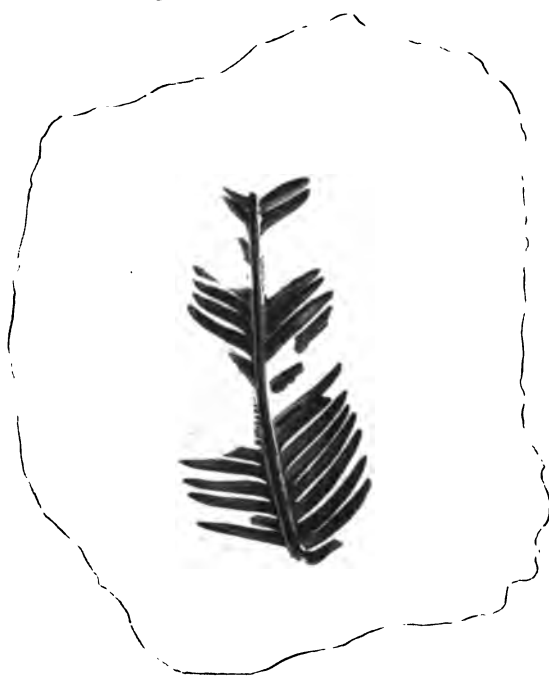
A coal measure fern, allied to *Neuropteris Loshü*, from which and all other species it differs in its leaflets becoming gradually smaller, till the terminal one is less than any of the others. This is an unusual circumstance in the genus *Neuropteris* and distinctly marks the species.

ZAMIA TAXINA.

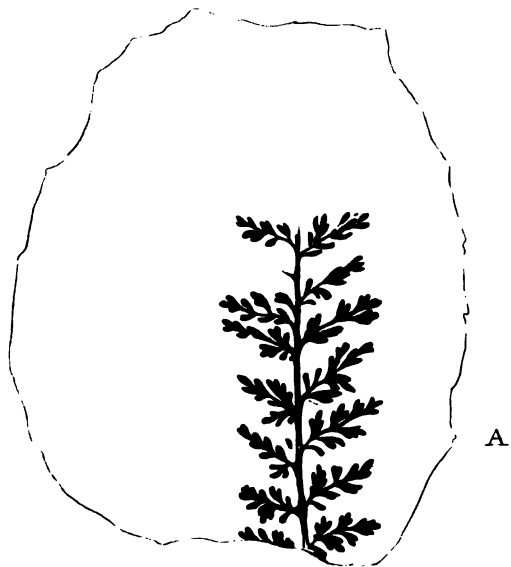
From the Stonesfield slate. Communicated by Dr. Buckland.

It occurs in specimens no larger than those now figured, and is so nearly allied to *Zamia pectinata* as to look like a small state of it. We are by no means assured that it really is not so, but its leaflets seem to be a little less approximated, and more gradually tapered to a point; and these circumstances, together with its size, induce us to look upon it as a distinct species.

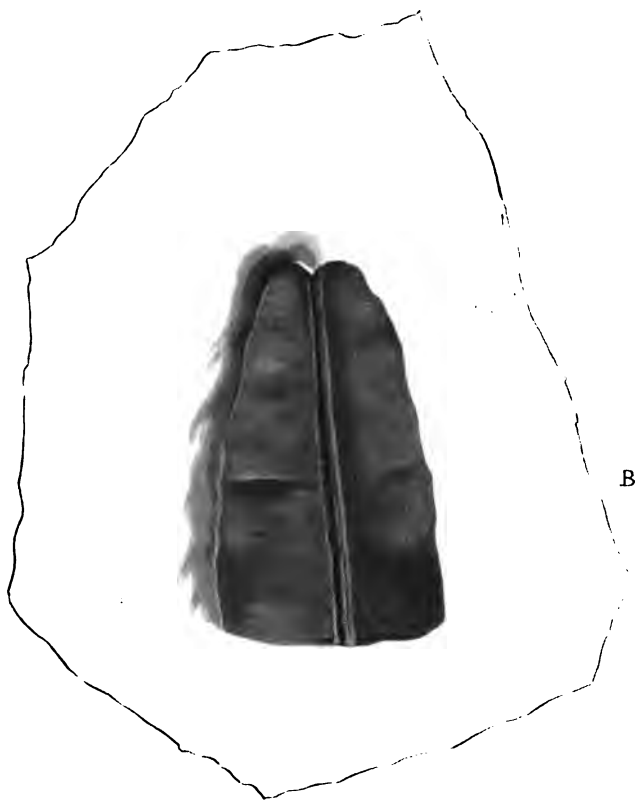




Pinus strobus L. var. *resinosa* A. Mill.



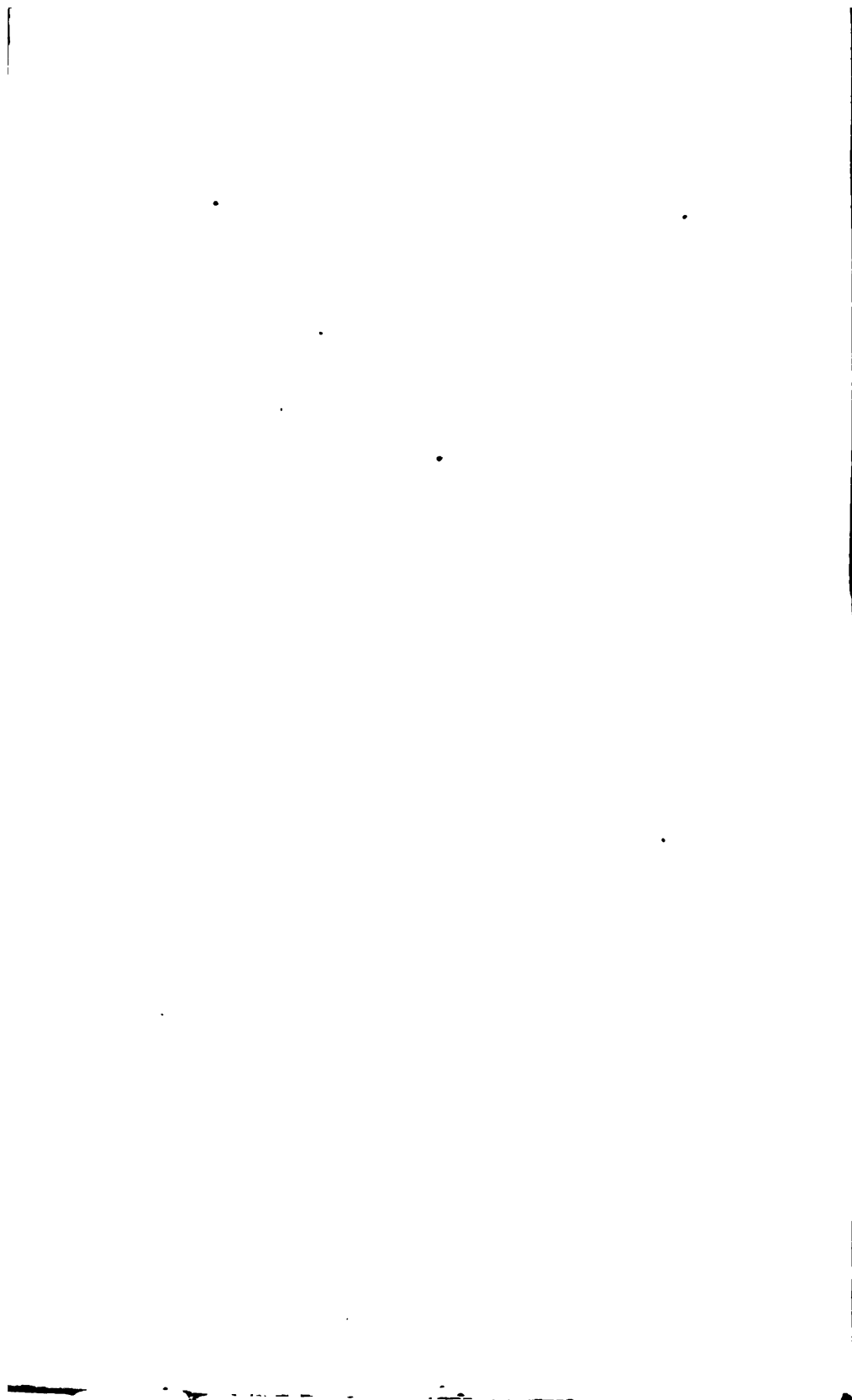
A



B

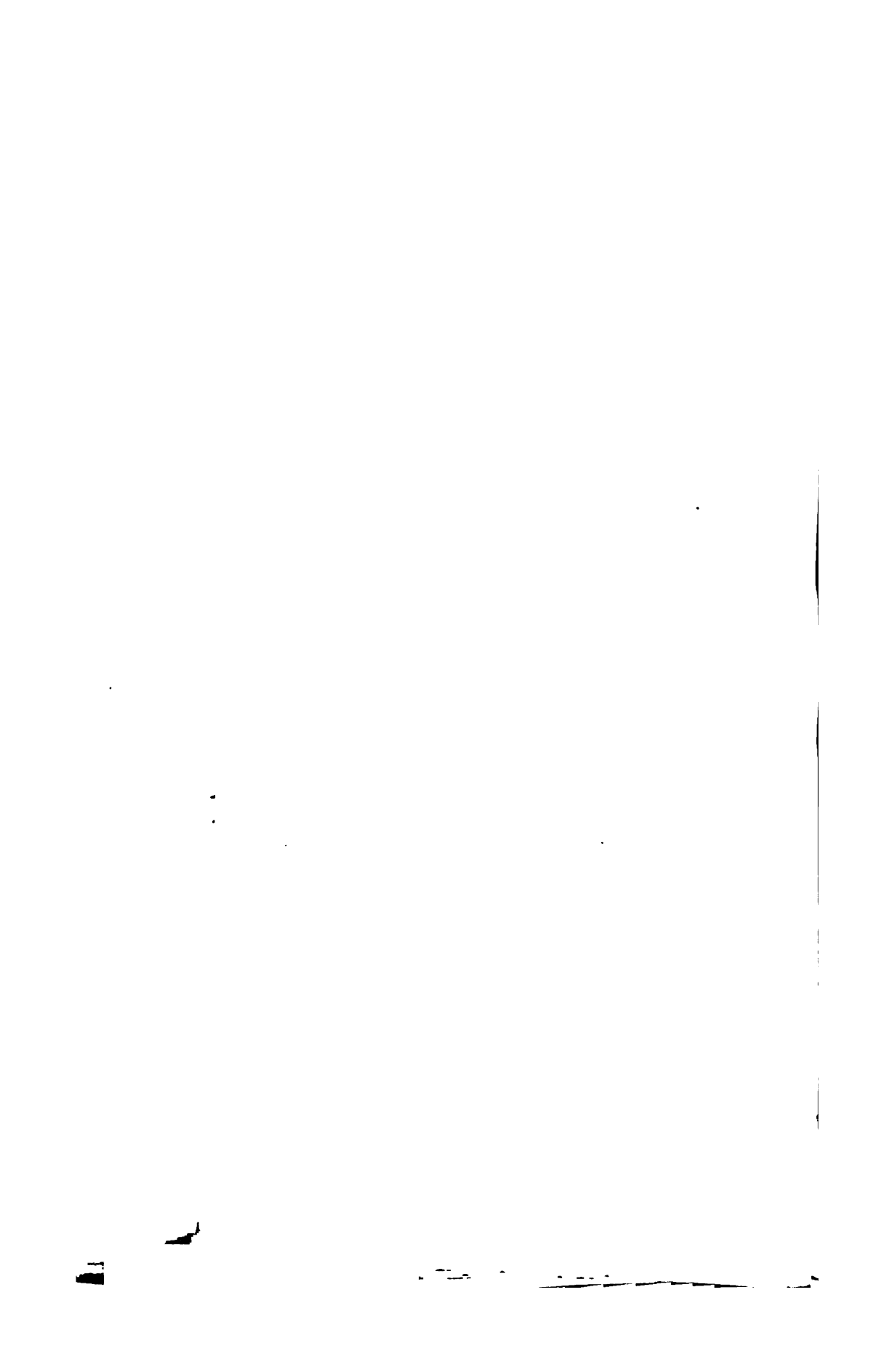
Magnified





Magnified.





SPHENOPTERIS HIBBERTI.

From a specimen, for which we are obliged to Dr. Hibbert, who procured it from an interesting deposit of fresh-water Limestone occurring at Kirkton near Bathgate, in the county of Linlithgow.

This is described in a memoir upon certain fresh-water Limestones, published in the Transactions of the Royal Society of Edinburgh, vol. xiii. from which we extract the following.

“A mile or two to the east of Bathgate, at Kirkton, we find that a very considerable outbreak of greenstone has occurred. Close to it on the west appears the limestone of Kirkton. By this contiguity, we are assured, that the limestone must have been elaborated within the immediate sphere and influence of an extensive volcanic eruption. The consequence has been, that one of the most unique formations of which Great Britain can boast, has

been formed, indicative of thermal waters, belonging to the carboniferous epoch.

"A decidedly fresh-water formation is thus exposed, which is characterised by the absence of all marine shells, corallines, &c., and the presence of the well known vegetable remains of the Coal formation.

"But the remarkable circumstance in this limestone is its mineralogical character, indicative of the very powerful chemical action under which it was elaborated. This chemical action appears to have been so energetic, as to have caused such miscellaneous earthy matters as are found to enter into the composition of an impure limestone, like that of Kirkton, to separate into laminæ, and to assume a sort of striped disposition (*rubané* as it is also named) resembling what I have occasionally noticed in Auvergne, where tertiary strata have come into contact with volcanic rocks. The strata, for instance, of Kirkton quarry, are composed of distinct and alternating thin laminæ, some of them being of remarkable tenuity, variously consisting either of pure calcareous matter, of translucent siliceous matter, resembling common flint, or of a mixed, argillaceous substance, which approaches to the character of porcellanite, or of ferruginous, or even of bituminous layers, originating probably from vegetable matter.

"Upon one of these very thin aluminous folia, which I have compared to porcellanite, I observed

the impression of a Fern, apparently of a Pecopteris, which was delineated upon it like a painting upon porcelain."

In many respects the specimen resembles *Sphenopteris polyphylla* of the Clee Hills (fol. 147), but it appears to differ in the following particulars. Its leaflets are less regularly three-lobed; when they are so lobed the central segment is scarcely different in size from those at the sides, and the latter taper more gradually into the stalk. These circumstances produce a considerable difference in the general appearance of the two plants, although they may not seem upon paper to be of much weight.

SPHENOPTERIS LATIFOLIA.

Sphenopteris latifolia. *Supra*, vol. 2. p. 156.

From the Bensham coal seam in Jarrow Colliery.

It is most difficult to form a correct opinion of what are distinct species and what are merely different parts of the leaf of the Ferns found in a fossil state, so much do the different portions of the leaves of recent species vary between their base and their apex; a property which we shall presently see was at least as strongly characteristic of the species of the ancient Flora.

At fol. 156 is represented a plant called *Sphenopteris latifolia*, which appears to differ from that

before us in the ultimate leaflets being scarcely ever three-lobed, but usually consisting of from five to seven divisions; here they are almost constantly three-lobed, the instances of five lobes being extremely rare. We are however persuaded that in reality the present plant with its 3-lobed leaflets is a portion of the upper end of a 5 or 7-lobed state, and it is far from improbable that *Sphenopteris dilatata* (vol. i. tab. 47) is again the extreme point of the leaf of such a species with leaflets altogether undivided or merely two-lobed.

At all events no safe geological inferences can be drawn from the presence of such remains; that is to say, supposing the plant figured at tab. 156 and the present, and that of tab. 47 were all found in separate stations, no one ought to consider such a fact of the slightest weight in shewing the three stations to be different formations.





Adiantum

Adiantum species



PECOPTERIS LOBIFOLIA.

Neuropteris lobifolia. *Phillips Geol. Yorks. t. 8. f. 13.*

Neuropteris undulata. *Supra, vol. 2. t. 83.*

Three specimens only of this plant have occurred in the lower sandstone and shale of the Oolitic formation at Haiburn Wyke near Scarborough.

Mr. Williamson, Jun. from whom we have received the drawing has made us the following communication upon the subject.

“ This bears a strong resemblance to *Neuropteris undulata*, figured by you some time ago ; belonging to which species I have also discovered a new character I had not observed in the specimen drawn, owing to its imperfect state. It consists in a large

lobed leaflet at the under part of the base of each pinnule, and is consequently the same species as that of which Professor Phillips has given a drawing under the name of *Neuropteris lobifolia*.

"The present species differs from that plant in having these lobed leaflets as well as the others much smaller, the lobes, although variable, more of an hexagonal form, and the nervures much fewer in number.

"Fig. 2 is a magnified view of the base of a pinnule of the present plant, and fig. 3 represents three of the leaflets from the extremity of a pinnule, the apex of each being broken off. Fig. 4 shows a similar portion of the original *Neuropteris undulata*."

Upon considering these additional points of information, and the drawing now published, it is in the first place apparent that the species is a *Pecopteris* and not a *Neuropteris*. For there is a manifest midrib, and the lateral veins are planted upon it abruptly; and secondly, that it is closely related to the *P. acutifolia* and *obtusifolia* represented at tab. 157 and 158 of the present work.

With regard to the differences pointed out by Mr. Williamson, we conceive they are not greater than might be expected upon different parts of the same leaf; and that while tab. 83 and 179, fig. 4, represent portions of the lower part of a leaf, t. 179, fig. 1. 2. 3. belong to the upper part of it.

ASTEROPHYLLITES TUBERCULATA.

Supra, vol. 1. t. 14.

From the roof of the Bensham coal seam in Jarrow Colliery.

We figure this fragment with a view to completing the representation given in the place above referred to, and to shewing that it is in all probability the remains of a mass of inflorescence, of which we have here a portion of the naked stalk. But we are still uncertain as to what it may have been or belonged to. There is some room for suspecting that it was a part of the fructification of *Calamites*, see tab. 15-16; but after a lapse of nearly five years we are as much in the dark upon this subject as ever.

It is wonderful that no one should ever yet have been able to find Calamites in actual connection with such remains as this ; and that being the fact the probability of the two belonging to each other is by no means increased.





Pick. by Mrs. P. Ridgway, London, Jan. 1836.

SPHENOPTERIS FURCATA.

Sphenopteris furcata. *Ad. Brongniart, Hist. des Vég. Foss.*
p. 179. t. 49. f. 4. 5.

From the roof of the Bensham coalseam in Jarrow Colliery.

Another of the large family of narrow-leaved *Sphenopterides*, to which *S. affinis*, *artemisizæfolia*, *crithmifolia*, &c. belong. It seems wholly impracticable to define the species, if species they be, with any precision; and it is probable that many of them will be one day considered mere forms of each other.

Newcastle, Charleroi, and Saarbruck are given by Mons. Adolphe Brongniart as localities for this species, which differs from *S. crithmifolia*, chiefly in its more compact mode of growth, and in the general outline formed by the points of the lobes of the pinnules being more broadly oblong.

PINUS CANARIENSIS.

We trust we shall stand excused for publishing this remarkable cone in the Fossil Flora, although it does not actually belong to the deposits of this country. We are the more induced to venture upon this departure from our original plan in consequence of the numerous other cones which have been already figured in this work.

It was found in Spain in the year 1832, by Colonel Silvertop, in a deposit of indurated whitish marle, containing powerful beds of sulphur, near the town of Hellin, in the province of Murcia. Impressions of fish are found in the same locality, which Professor Buckland considers a tertiary formation.

What this cone may have been in an age so nearly approaching to the present order of things becomes a highly interesting point.

The specimen from which our drawing was taken

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Pub. by Messrs Ridgway, London, Jan'y 1836.



NEUROPTERIS HETEROPHYLLA.

N. heterophylla. *Ad. Brongn. Hist. des Vég. Foss. p. 243. t. 71. 72. f. 2.*

N. acutifolia. *Ad. Brongn. Hist. des Vég. Foss. p. 231. t. 64. f. 6, 7.*

Filicites heterophylla. *Ad. Brongn. Class. Vég. Foss. t. 2. f. 6.*

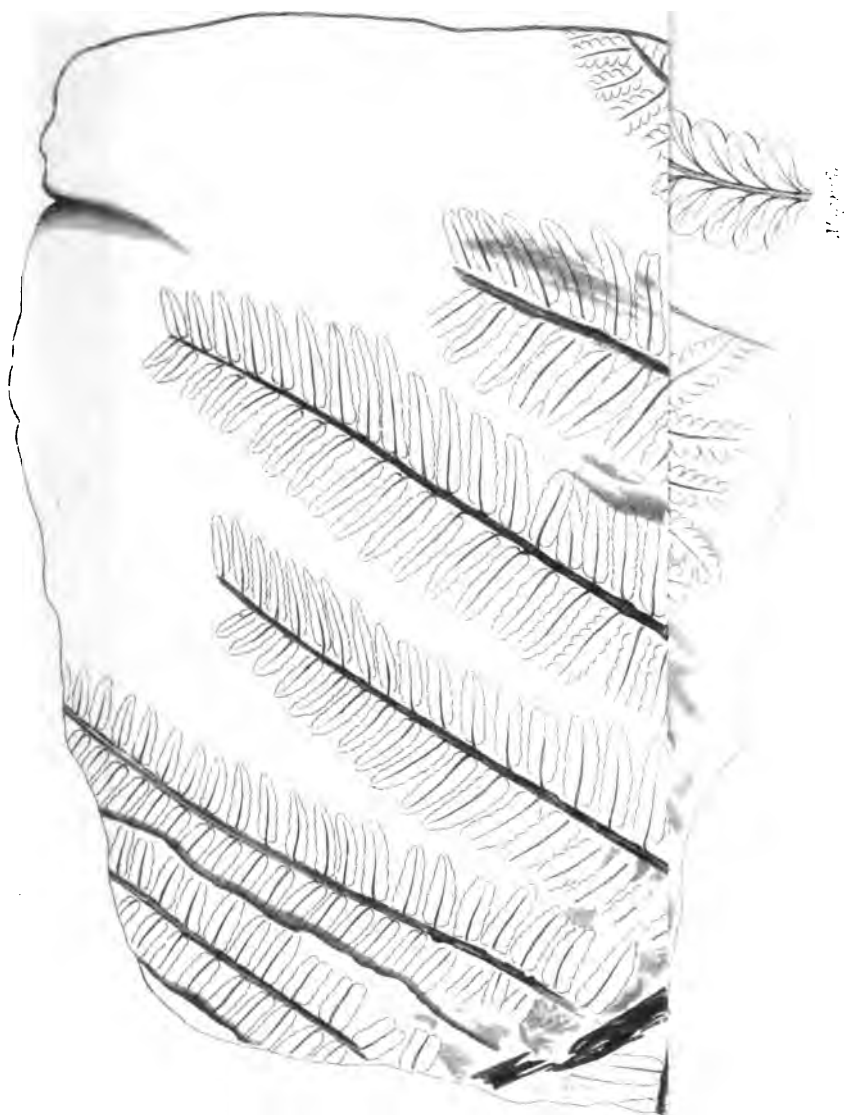
Pecopteris Dethiersii. *Id. Prodr. p. 56.*

For this remarkable specimen we are indebted to Mr. W. D. Saull, who purchased it out of the Museum of the late Mr. Sowerby. It lies in a large nodule of Ironstone, and is in a singularly perfect state. That it belongs to some of the old Coal-measure formations admits of no doubt.

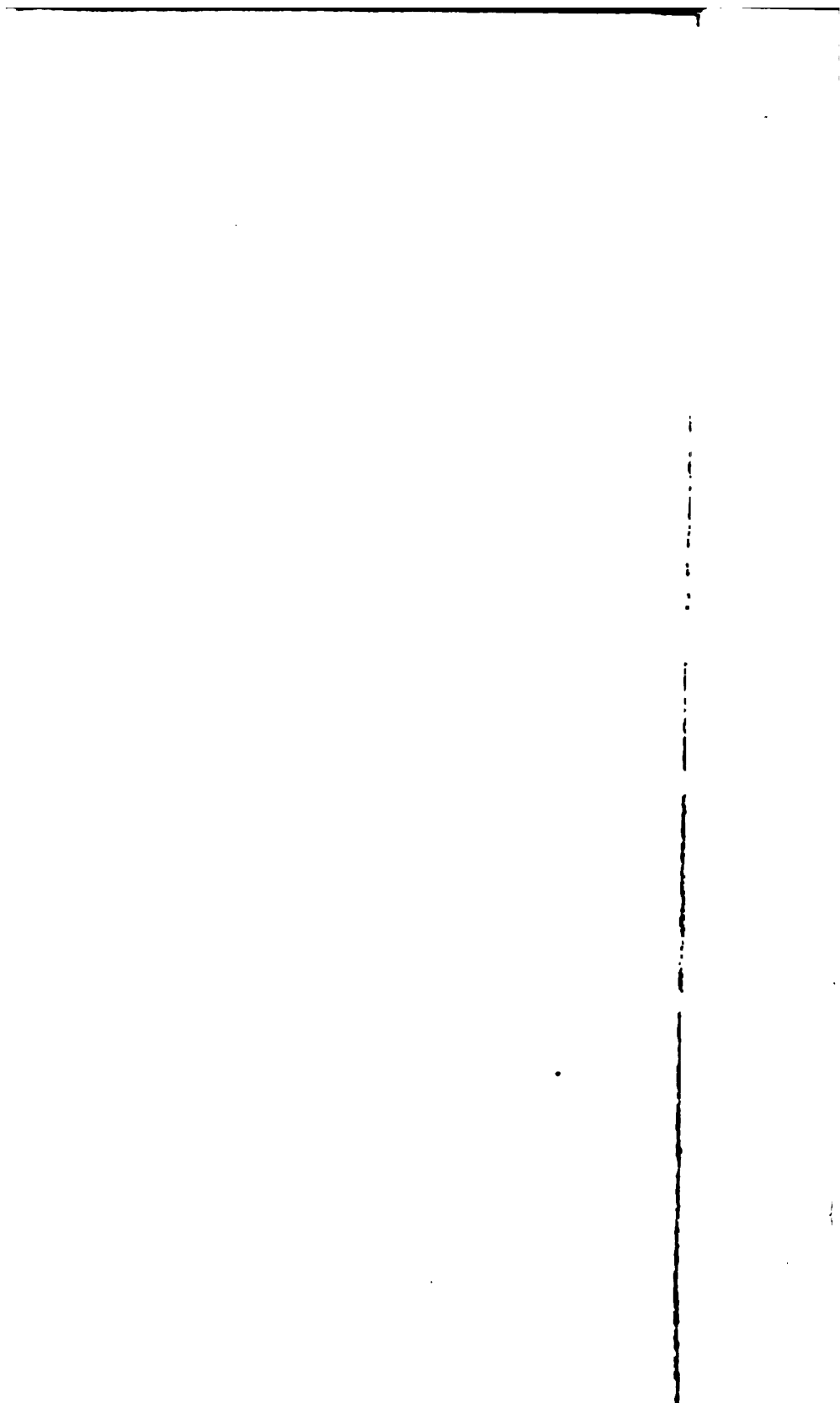
It was probably the end of a leaf of some Fern of large dimensions, and seems, from its convexity, to have been originally of a tough and thick consistence. What is most remarkable in it is that the leaflets of the very same portion of a leaf should be so extremely different on opposite sides of the same

rachis. On the right, the pinnæ are about two inches long, cordate, a little wavy, and altogether undivided; while on the left they are three inches long, deeply pinnatifid into about seven pairs of ovate lobes, and a terminal one resembling the entire pinnæ on the opposite side, except in being much smaller.

Hence it has been well named *N. heterophylla*, by Mons. Adolphe Brongniart, who figures it from the coalfields of Charleroi and Saarbruck. It appears to us that the *N. acutifolia* of the same Botanist, from Wilksbarre in Pennsylvania and from Bath, also consists of the entire pinnules of this same plant; and that it is even doubtful whether *N. Loshii*, *angustifolia*, and *Scheuchzeri* are not all fragments of this same species.



P. p. p.



PECOPTERIS ABBREVIATA.

P. abbreviata. *Ad. Brongn. Prodr. p. 58. Vég. Foss. 1. p. 337. t. 115. fig. 1—4.*

From the coal measures of Welbatch near Shrewsbury, communicated by Mr. Corbett. It is described by M. Adolphe Brongniart, from the Bath coal-field and from the mines of Anzin near Valenciennes.

Among all the species of *Pecopteris* this is known by the pinnæ being merely crenelled, with from three to five veins occupying the middle of each crenature. It appears from M. Adolphe Brongniart's figure that the number of the veins is sometimes increased, but we have not remarked that circumstance in the specimen before us.

FUCOIDES ARCUATUS.

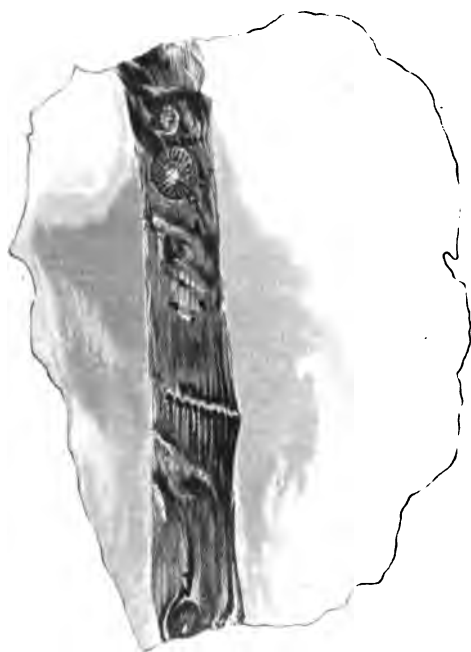
From the collection of Professor Phillips, who states that it is the only one he has seen from the extinct flora of Gristhorpe.

It does not appear referable to any of the species figured in Brongniart's *Végétaux fossiles*, neither does it approach any modern species, so far as it is possible to judge from the fragment before us. We do not however see any reason to doubt its being a Furoid, and that is all that can be said about it.

We presume the white spaces which divide each lobe of the plant into two parallel portions, represent the place where a thickened midrib once existed.

1





Magnified.

something in the way of the phragma of a Calamite. These disks, which look like the scars left behind by branches that had fallen off, are not stationed at the axils or the articulations, but appear at uncertain points on the internodes, and according to Mr. Williamson, Jun. are found less frequently on the stem than loose in the shale, without any apparent connection with the plant. This is a singular fact, and would lead one to think that the disks hardly belong to the stems with which they are found associated.

We retain Mr. Phillips's name, in consequence of the great obscurity that attends the species; but we may remark that we are by no means satisfied that it is the remains of an *Equisetum*.

PECOPTERIS HAIBURNENSIS.

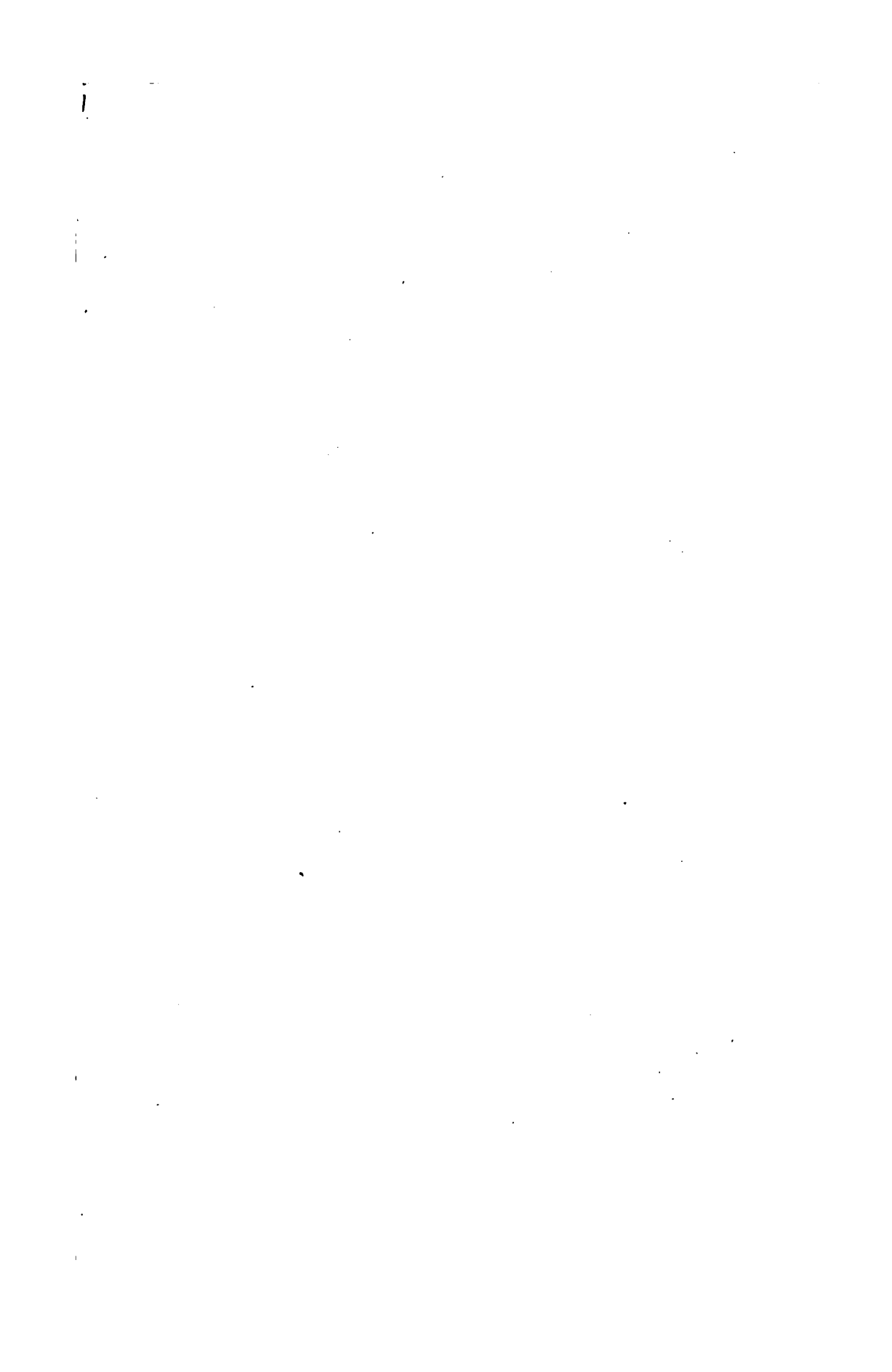


Communicated by Professor Phillips from Haiburn Wyke on the east coast of Yorkshire, where a small colliery is worked in the lowest beds of the Oolitic series.

It appears essentially distinct from all the species hitherto figured of this extensive and difficult genus, but it approaches the *P. pteroides* of the Coal Measures. It is apparently distinguished however not only by its greater size, but also by its more membranous texture, and by the lowest pinnule of each pinna not being placed very obliquely in the angle formed by the separation of the partial from the common rachis.

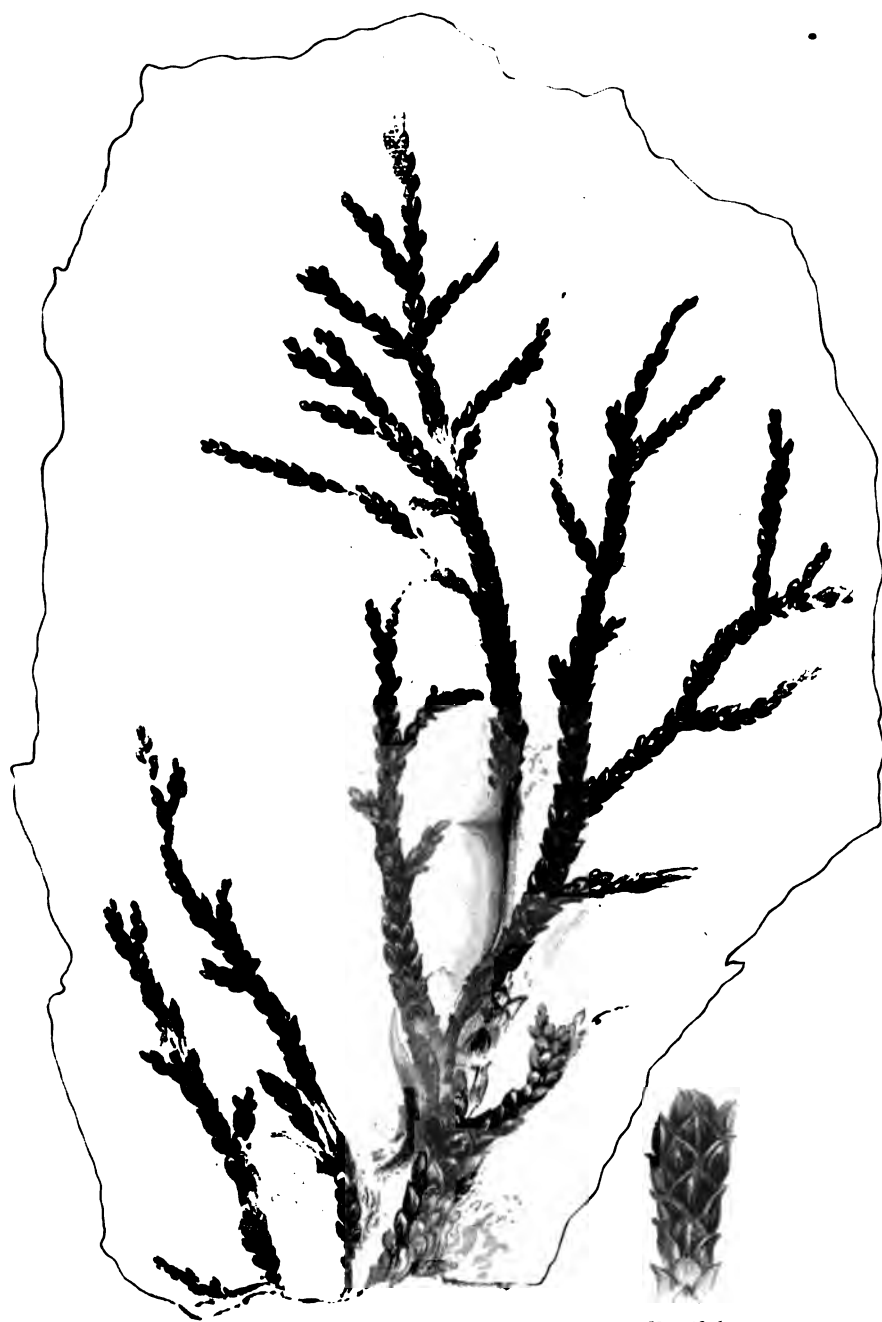
In the magnified representation in the accompanying plate, the artist has drawn the separate pinnule as if it adhered to its rachis by the centre only; but we believe this appearance to be caused by a decay of a portion of the base of the pinnule.

In general the pinnules adhere by their whole base, so that the pinnæ are pinnatifid rather than pinnate. This is correctly shown in the principal figure.





Magnified.



Magnified.

BRACHYPHYLLUM MAMMILLARE.

Brachyphyllum mammillare. *A. Brongn. Prodr. p. 109.*

Communicated by Professor Phillips, from the Oolitic coal-field of Haiburn Wyke, in Yorkshire.

M. Adolphe Brongniart considers this as a doubtful Coniferous plant; but it must be confessed that it has as strong a claim to be received as an unquestionable species of the Pine tribe, as any other fossil of which the leaves alone are known.

Its general appearance, and the arrangement of its leaves, which are all that we have to guide us in forming an opinion of its analogies, are quite those of the Coniferous plants allied to *Araucaria excelsa*, *Callitris* and *Dacrydium*.

Fig. 1. 2. 4.

CARPOLITHES CONICA.

From the Coralline Oolite of Malton, whence Mr. Williamson, Jun. has sent specimens to Professor Buckland, and drawings to ourselves. We have also seen it from Dr. Murray of Scarborough.

It is the remains of some fruit. The specimens are conical and three-sided, with the base(?) convex and bordered with a single row of tubercles, and divided by three elevated ridges, while the sides are perfectly smooth. Sometimes the three-sided character is absent, and the specimens are merely flattened, with an elevated edge on each side, and an elevated line passing through the truncated end. The greater part seem to have lost their external rind, but in one specimen, communicated by Pro-

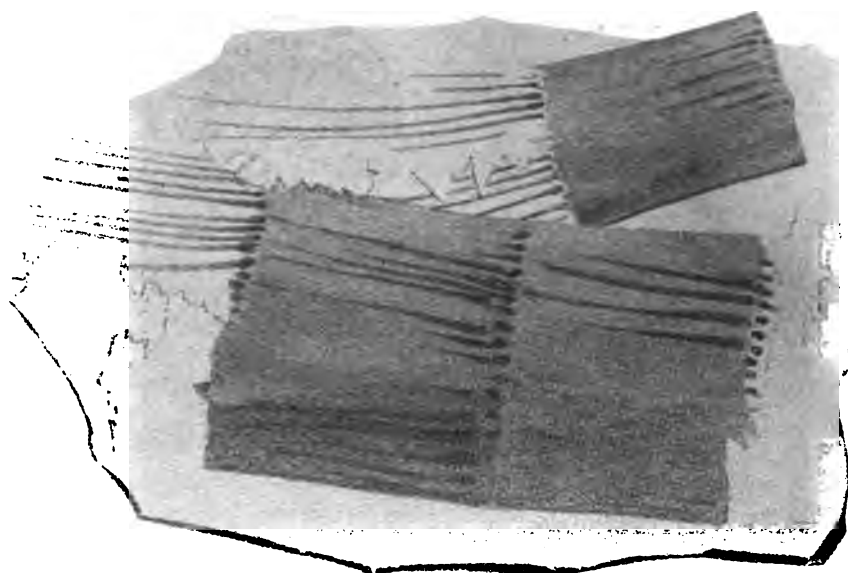
“They are generally of a rounded or rather flattened form. The base, or part of attachment, is surrounded by a ring of prominent but often irregular tubercles. The space within the circle is generally divided in three by elevated ridges, which I can compare to nothing so aptly as to the lines of carbonate of Lime in a nodule of Septarium. But these lines rarely pass beyond the circle, and in No. 3. do not exist; a slightly elevated tubercle forms the centre. The other parts of the fossil are covered with very irregularly placed tubercles, the spaces between which are quite smooth. In none of the specimens I have seen, which have not been few, was there any appearance of a division into lobes. The specimens are of a deep brown colour.”

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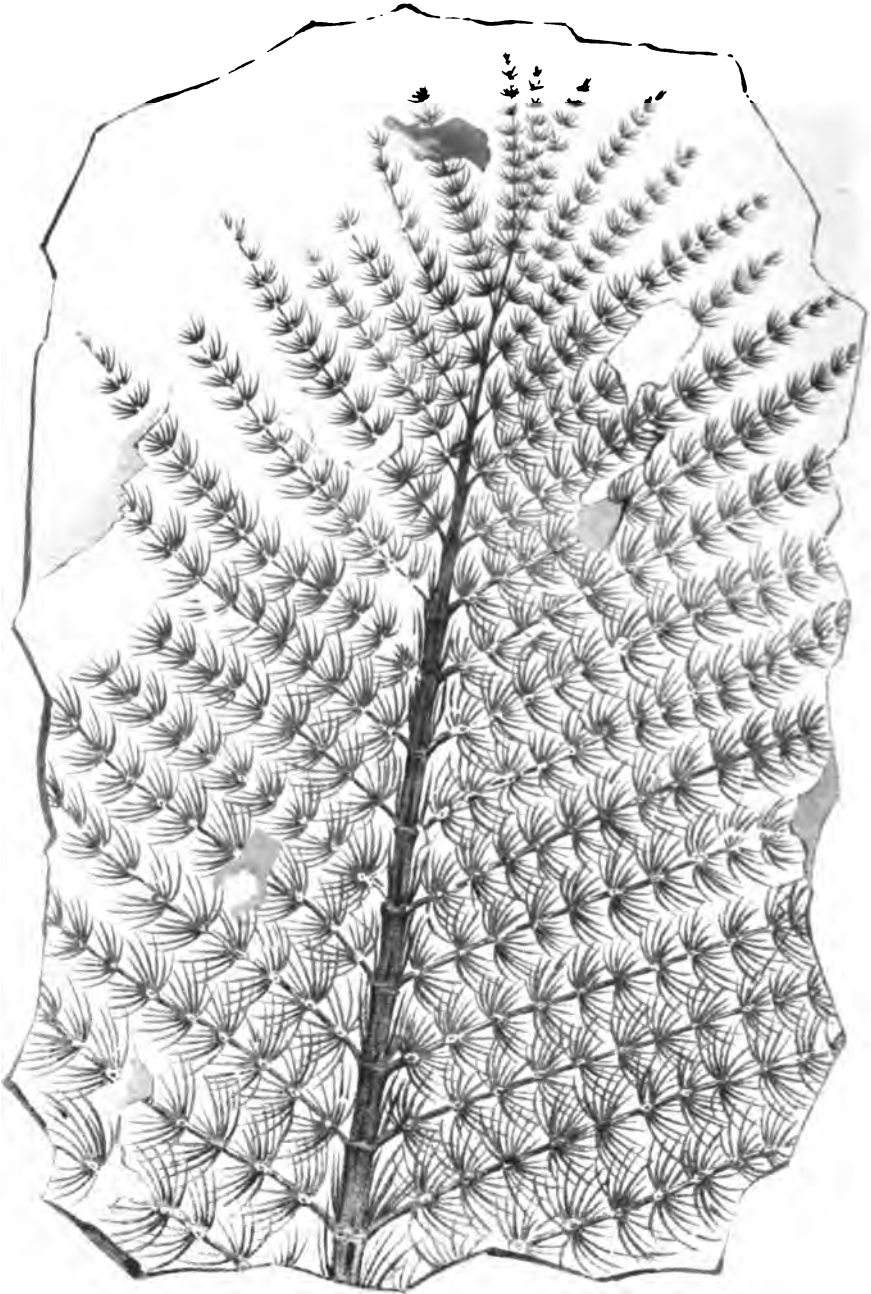
HIPPURITES LONGIFOLIA.

At t. 114 of the second volume of this work is figured the original species of this genus, from the Newcastle coal-field.

By the kindness of Mr. Arthur Montague, of Park End near Lydney, in the Forest of Dean, we are furnished with the accompanying representations of what seems another species, specimens of which exist in the collection of himself and Mr. Henry James. They occurred in the shale of the Forest of Dean coal basin.

This appears to differ from *H. gigantea* in the leaves being longer than the spaces between them, and the stem being quite smooth.

Fig. 190 represents some fragments of the stem and leaves of the natural size ; fig. 191 is a diminished figure of a considerable portion.



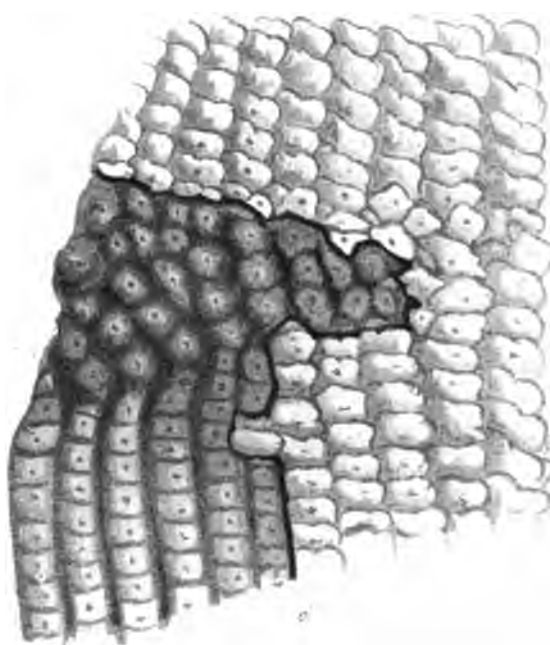
Pub. by Messrs. Ridgway, London, Apr. 1836.



a



b



c

FAVULARIA NODOSA.

Favularia nodosa. Bowman Mss.

For the drawing and following account of these remarkable remains, we are indebted to J. E. Bowman, Esq. of Gresford near Wrexham.

“From the roof of the lowest bed of Coal at Flint Marsh Colliery, on the estuary of the Dee, among abundance of *Sigillariæ* and *Calamites* of large dimensions.

“This beautiful fossil is in fine soft shale, and retains on one side the carbonized exterior surface of its vegetable form. The undulations and pencillings of the areolæ, to which the basis of the leaves have been attached, are as clear and sharp

as the impression from a seal, and even require the lens to shew their delicate inequalities. These areolæ cover the whole surface, are wider than their length, and not only touch the intermediate furrow, but give it a waved character, by encroaching upon the contiguous row beyond it, right and left. They are separated from those above and below in the same row, by slightly and uniformly diagonal lines or septa, which throw them into rhombs. In this specimen the surface is flat, but in others, detached portions of the rows have a considerable elevation, with the intermediate furrow deep in proportion. Where this is the case, the shale is seen to be more strongly impregnated with iron, which circumstance may have caused it to *set*, or harden quicker from its soft state, and so, more effectually to resist the superincumbent pressure. In the elevated parts, the transverse divisions of the rows, are nearly at right angles with the axis of the stem, which shews that their diagonal or slanting direction in the flatter parts, is the result of pressure, and not of a spiral arrangement of the leaves, as in *Lepidodendra* and modern *Coniferæ*. This will be evident by observing that the diagonal septa *ascend* from right to left on one side of the fossil, and from left to right on the opposite one; while all spirals ascend in the *same* direction, on which side soever they are viewed, as the stem of the Hop or Kidney-bean on its pole, or a thread wound round the finger from the base to the tip; and these fossils are only flattened cylinders.

“In its decorticated portions, the present somewhat resembles *Favularia tessellata*, already figured at plates 73 and 74 of this work ; but the furrows, from the cause above mentioned, are somewhat wavy or zigzag, the areolæ rhomboidal and shorter in proportion to their width, and the central scar, or vascular connection between the leaves and the interior of the stem, of an elevated circular or horse-shoe form, around and within which the general surface is depressed. In *F. tessellata* this portion is shaped like the club upon playing cards, with the central lobe elongated, and reaching nearly to the apex. It was not clearly stated in describing that fossil, that the engravings shew its *decorticated* appearance, and that the exterior carbonized surface is in no part well preserved.

“The irregularly warted zone which crosses the central portion of the fossil, interrupting the longitudinal rows, gives the idea of a joint, or division of the stem. As this mark occurs in a precisely similar situation, on both sides of eight or nine other specimens, and as no instance of a jointed structure has yet, (as far as I am aware) been found in any *Favularia* or *Sigillaria*, it may be worth while to examine how far it goes to support that character. I once thought it might be the effect of a twist or bruise the vegetable had received while in a soft state ; but a more attentive examination, shewed that some such accident had actually happened in another portion of the decorticated surface, and had

left the impression of an irregular transverse rent, with a sharp jagged edge, but without affecting the opposite side. I am therefore satisfied from this, and from the smooth unbroken undulations of the zone, that it is a part of the vegetable itself. Its inequalities have, however, been more strongly impressed on its interior than on its exterior surface. Indeed the areolæ, though much transposed, and less densely imbricated in these parts, are never absent, and where they retain their carbonized surface, there is no exterior trace of joint or sheath, as in *Calamites* or *Grasses*. Again, in all the specimens, the longitudinal rows of areolæ, after having been more or less thrown out of their perpendicular direction, in the neighbourhood of the zones, soon regain their natural position. In two or three instances, however, an additional row is inserted, the space for which has been made by the bend or divergence of several of the collateral rows on each side, from their parallelism; but neither the one nor the other is narrower than the rest, in consequence of this intrusion. Lastly, in all the specimens before me, the zones or joints occur on both surfaces, and intersect the axis of the stem, at precisely the same angle as the transverse divisions of the areolæ. Though I have shewn that this diagonal direction is the result of pressure, the coincidence of the joints is a fact of great importance as pointing to a common cause in the structure of the plant, and proving their original

position to have been at right angles with the axis of the stem. On the whole it appears highly probable that these zones indicate the jointed structure of such plants as *Favularia* (and perhaps we may add, from general analogy, of *Sigillaria* also) but that the joints were not accompanied by any other external appearance than a less densely imbricated and perhaps a longer foliage, and an interruption of the parallelism of the rows. As there is no trace of ramification in any of the specimens, it occurred to me whether these joints might be the rudiments of a whorl of branches, as in recent *Coniferæ* ; but the bases are not broad enough to render this probable. In one instance only, two joints occur in the same specimen, viz., one at each end, separated by an interval of $4\frac{1}{2}$ inches, which may help to convey an idea of the real character and habit of these wonderful vegetables. If we suppose for a moment that the joints were ramuli, or whorls of longer foliage, the plant would not be very dissimilar to a gigantic *Equisetum* or *Hippuris*, whose stem was concealed by leaves or scales.

"The specimens are all completely covered on both sides with areolæ, arranged in perpendicular rows, which seem to lock into each other, and to form a rich mosaic work. It is singular that one surface should retain its carbonized exterior, and the other be for the most part decorticated. Yet they all are so. They are also generally broken off at the joints, but there is no interpal trace of a

phragma, or of a central wooded axis. As the specimen figured (which is 10 inches long by nearly 6 wide) is not half an inch thick, and not more than a quarter of an inch about the edges or sides, the absence of an axis goes far to prove that such plants were destitute of that arrangement. And if they had a jointed structure, the nodi must have been soft and perishable, as the thickness of the fossil is not greater where they occur.

“ I am not aware that either the leaves or fruit of these primæval vegetables have ever been found, or at least identified. From the evidence we have of the abundance of the former, we are almost driven to the conclusion that they must have been supposed to belong to some other fossil, or that they have been of a soft and succulent nature, and have yielded to the wasting causes which the tougher material of the stem has resisted. Is it an improbable conjecture, judging from the very broad thick base by which they were attached to the stem, that in mature plants, they each formed an involucre, enveloping one or more seeds, like the leaves of *Isoetes*, or the imbricated scales of the cones of the *Pinus* family ?”

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- a. Shews the exterior surface, which is of coal, as beautifully sharp and perfect as the finest impression of a seal. The inequalities of the surface are but slight ; but some of the more delicate lights and shades are so fine, I have not attempted to express them.

- b.* A portion of another specimen of the same fossil, shewing the interior surface or decorticated state, after the removal of the coaly shell. In this specimen the leaves are not quite so closely set.
- c.* Portion of the same specimen as *a*, remarkable for the different arrangement of the leaves in the central part, where they seem to be disposed spirally or alternately, and in the specimen itself give the idea of a joint; this sketch shows a part of the exterior leaf-bases, and some of the decorticated portion.

A. 1, 2, 3, 4.

CARPOLITHES ———.

Fossil seeds from the calcareous Slate of Stonesfield, one of the subdivisions of the lower portion of the Oolitic series, so remarkable for the singular variety of its organic remains. The specimens are from the collection of Professor Phillips, who observes—"In general they may be affirmed to have much analogy with the Monocotyledonous fruit from the Oolite of Malton (*Carpolithes conica*, t. 189). The nourishing vessels have left prominent marks; on one flat plate is a very singular arrangement."

We find nothing sufficiently remarkable in the specimens to enable us to give even a guess at their affinity; and it is even probable that three different species are here combined, namely A. 1 & 3; A. 2; and A. 4.

B. 1, 2, 3, 4.

TRIGONOCARPUM NOEGGERATHI.

This has already been published at t. 142. of the 2nd volume of this work. The specimens before us occurred in the Newcastle coal-field, where, however, the fossil is rare; it is always in groups when it is met with. The specimens are less water-worn than those before published, and will serve to give a more distinct idea of the species. They have been communicated to us from Holywell Colliery, by John Buddle, Esq., and from Wilmington Colliery, by Geo. Johnson, Esq.

A 1



A 2



A 4



C



A 3



B 1



B 2



B 3



B 4





ZAMIA LANCEOLATA.

From the Oolite at Haiburn Wyke, near Scarborough, whence a drawing and description have been sent us by Mr. Williamson, Jun.

“The rachis was straight, and apparently smooth. The pinnæ were long and lanceolate, contracting at their base into the appearance of a short stalk; sometimes they were opposite, sometimes alternate; their surface is covered with a series of minute longitudinal striæ, apparently simple, and not running out at the side of the leaf as in *Otopteris*; but the seam in which the Haiburn plants are found, being of a more micaceous nature than that at Gristhorpe, veins and delicate markings are rarely preserved.”

This leaf has no doubt been produced by some one of the Cycadeoideous stems of the Oolitic Rocks, but there seems no present probability of our ascertaining by which.

in mere fragments; so abundant were they, that one layer of shale, not more than eighteen inches thick, in a space of ten feet square, furnished indications of several hundred individuals. In this shale-bed fragments of vegetable remains were found, but too indistinct to allow of identification; they had evidently possessed considerable substance, but were changed into a fine shining coal.

The leaves of this plant appear to have been about half an inch long, rounded at the extremity, decurrent at the back, and arranged regularly over the surface of the stem. Whether the crushed end was a portion of the fructification, the specimen does not shew; but we agree with Professor Phillips, in considering it analogous to the *Voltzias* of the new red sandstone. It may, however, have been an *Araucaria*, allied to *Araucaria excelsa*.

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Pub by Mrs "Rudgway Jan" 1837.



Fig. by M. G. Ridgway Jan. 1883

CALAMITES INEQUALIS.

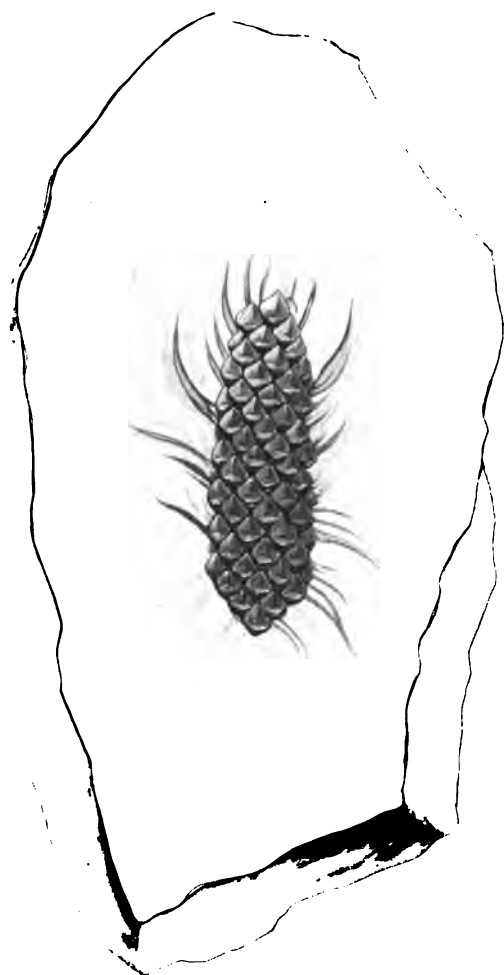
From the collection of Professor Phillips, who says, "This Calamites is, I think, a new species. Its irregular swellings, and unsymmetrical ramifications are remarkable. I found it with a thousand others, chiefly of the ordinary forms of Calamites, in a sandstone quarry east of Sheffield in 1827 ; in which quarry you might easily obtain specimens four feet long, and not much tapering ; no roots are there seen, but the stems lie in all directions in the sandstone."

It is most nearly related to *C. Voltzii*, with which it corresponds in its lateral scars, and irregular manner of growth ; but it seems to differ in its joints not regularly diminishing in size. The nodes are remarkably tumid at places, as if knots were formed in the substance of the plant ; and, what is very interesting, the specimens confirm the opinion that Calamites were hollow. The cylinder that once was of vegetable matter has altogether a different texture from the interior, which is a coarse grit that separates freely from the stem itself.

The species derives its name from the diversity of form in the leaflets of different parts of the same leaf. In the specimen now figured they are all of the same oblong figure, and altogether undivided; but in other parts they are furnished with auricles at the base (*see tab. 200.*), and so acquire, when not observed in connection with each other, the appearance of entirely different species. This peculiarity is by no means confined to Fossil Ferns, but also occurs in several modern species of *Pteris*.



Magnolia



Phaenocarpa sp. (Diptera: Tephritidae) - 1917



LEPIDOSTROBUS PINASTER.

From the coal at South Shields: communicated by Thomas Stephens, Esq., North Shields.

This new species of *Lepidostrobus* has several well marked characters that distinguish it from those already known. Its form is more narrow; its scales have a more prominent scar; their leafy points *seem* to have been more rigid; and the number of scales that the impression exhibits across it does not exceed three. The scales are rhomboidal, with a transverse oval scar at the end which is most rounded; and that end is thicker and bevelled off at the edge. In the middle of that margin of the oval scar which is next the bevelled edge is a small tubercle. Nothing is distinctly seen of the leafy points; but there are streaks and stains as shewn in the figure, which may possibly be their remains.

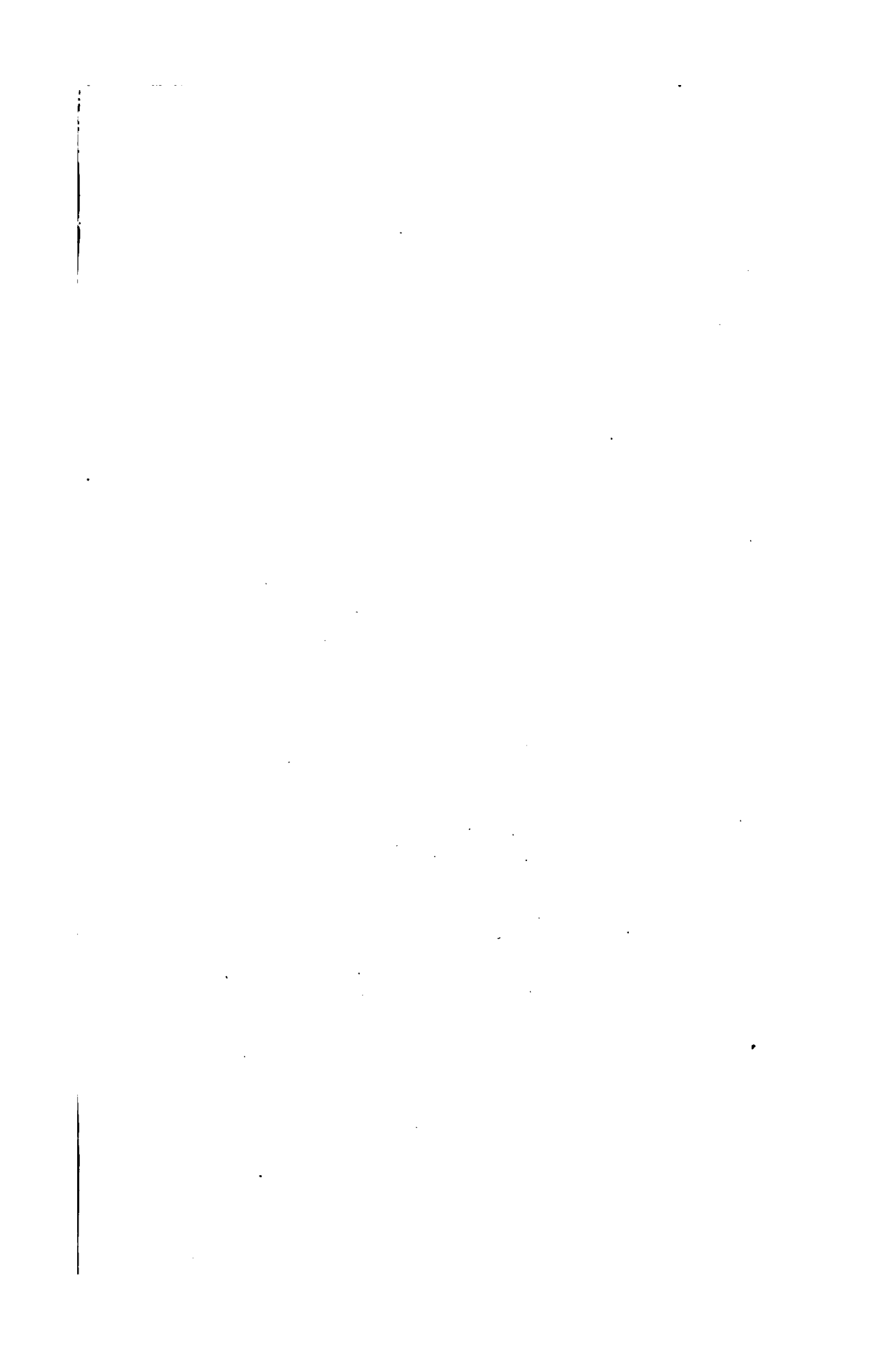
Although the cone is so placed in our figure as to
VOL. III. K

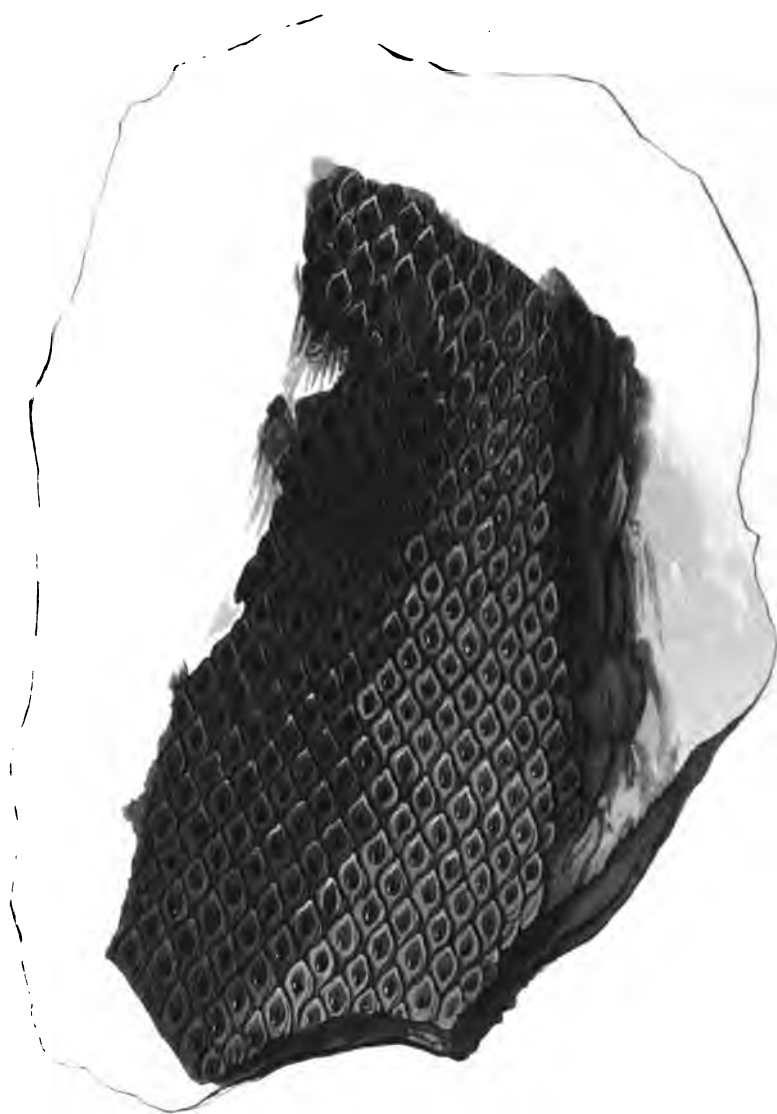
have its broadest end downwards, yet we are by no means certain that it is not inverted; on the contrary, as the bevelled end of the scales is at the base, when the cone is in this position, and as in recent cones it is invariably at the apex, it is probable that the greater width of one end than the other, which by the way is exaggerated in the figure, is owing to the scales of the upper end of the cone having opened a little, while those of the base remain closely pressed together.

LEPIDODENDRON ELEGANS.

L. elegans. Suprà vol. 2. tab. 118.

This beautiful impression of the surface of a large arm of *Lepidodendron elegans*, is from Felling Colliery. It is of the natural size, and completes the figure already given of the species in the place above referred to.







NEUROPTERIS HETEROPHYLLA.

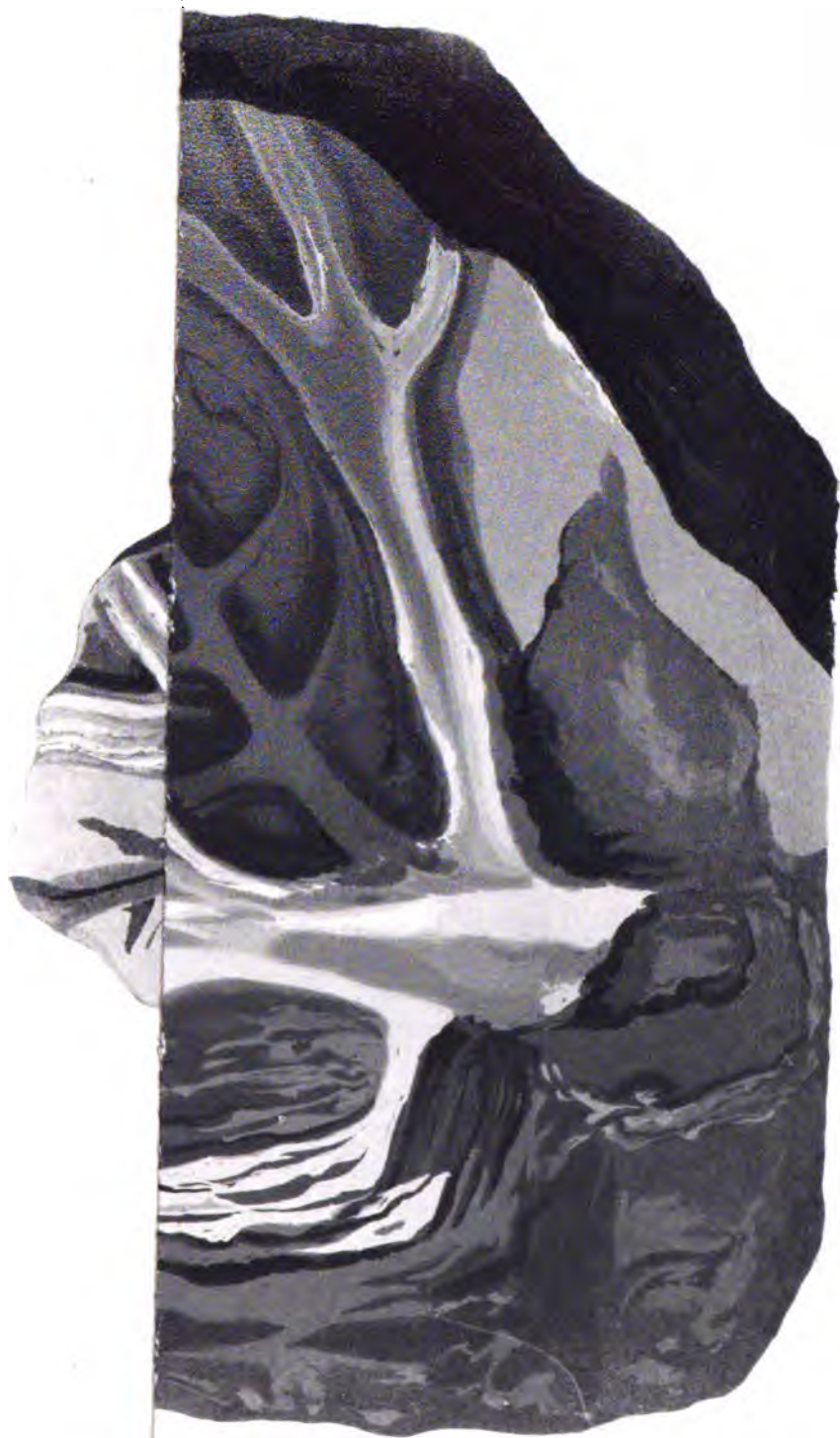
N. heterophylla. *Suprà Tab. 197.*

From Jarrow Colliery.

It is here that the separation of the leaflets of this fern becomes apparent. A collector would hardly suspect the specimen now before us, and that figured at tab. 197, to belong to the very same species, and yet the beautiful specimen figured by M. Adolphe Brongniart, at tab. 71 of his work on Fossil Plants, demonstrates the fact.

The species is near *N. Loshii*, tab. 49, from which it differs according to Brongniart in the following particulars. "In that species the pinnæ succeed each other on the common rachis for a

considerable space almost without alteration of form or size; but in *N. heterophylla* they diminish rapidly, and the pinnæ as well as the pinnules then assume very different forms. Towards the extremity of the pinnæ, on the contrary, the diminution is slower, the general figure more lanceolate, more acute, and the last lateral pinnules are much more lengthened. It is nevertheless possible that both plants may be only varieties of the same species;" a suspicion in which we are not only quite inclined to participate, but which we think might be well applied to many other cases.





DICTYOPHYLLUM CRASSINERVIUM.

So very little is known of the plants belonging to the new red sandstone formation, that during the progress of this work we have never before had an opportunity of describing a single species. For the fine specimen now presented to our readers we are indebted to J. Walker, Esq. President of the Liverpool Institution, who brought it to London at the request of Mr. Murchison.

It was found in what the latter gentleman considers the central part of the new red sandstone system of Great Britain, while excavating the Clarence Dock at Liverpool, and was presented to the Liverpool Institution by Dr. Traill.

The specimen is that of a leaf of considerable size, of which only a portion of the upper end remains, the end itself and all the margin being broken off. It bears a striking resemblance to the leaf of some of the thick-ribbed cabbages, consist-

ing of several elevated ribs, full three-quarters of an inch wide, which spring at an acute angle from a midrib of about the same thickness, and divide towards the point into two or three branches, besides in one place putting out lateral ribs near the base. Intermediate to the principal ribs are, in one place, transverse connecting elevations which we may suppose to have been secondary veins ; and in another place a small vein with lateral veinlets. In the whole specimen there is a good deal of irregularity of arrangement in the parts, and a greater want of symmetry than is usual in leaves.

Nothing like this has before been seen either from the new red sandstone, or any of the beds below the chalk. With the Voltzias, and other fragments described by M. Adolphe Brongniart it has not a single character in common ; and what is more important it is beyond all cavil a Dicotyledonous leaf. What it was there is, indeed, no evidence to shew ; and there is no object in offering mere guesses upon the subject.

This is an interesting fact ; for as it has been considered that our *Dictyophyllum rugosum*, t. 104, from the Oolite, is a Fern and not a Dicotyledonous leaf, as we however still believe, there was till now nothing positive to oppose to the opinion of a learned geologist that no Dicotyledonous remains, except of Coniferæ, would be found in the beds below the Chalk. For ourselves we are persuaded

that geology offers no ground for assuming the exclusion of Dicotyledons from the primitive flora; on the contrary, nothing opposed to the present design of the creation has yet been seen in any part of the flora of even the most remote periods, and if there is a general absence of the remains of Dicotyledons in the older rocks, it is surely more philosophical to ascribe that circumstance to the destruction of such plants, than to assume that this great class of vegetation, which now comprehends two-thirds of all existing species, is of comparatively modern creation. To say this is little short of an assertion that the whole plan of organization of the Vegetable world has been altered since it was first called into existence out of chaos.



From the *Weymouth Limestone*, 1847.



4. 1. 1868

LEPIDODENDRON STERNBERGII.

L. Sternbergii. *Suprà vol. 1. t. 4.*

We have already been so fortunate as to throw some light upon the nature of this extinct genus, in former articles in the present work. The accompanying plate will serve to complete its illustration as far as our knowledge at present goes.

It is the figure of a magnificent individual, which has lately made its appearance in the roof of the Bensham Coal seam, in Jarrow Colliery. It occurs in the great deposit of vegetable fossils which is there, as elsewhere, twelve to eighteen inches above the seam of coal, and fortunately has been overthrown or settled down in a north and south direction, which being that of the gallery, it is plainly to be seen throughout its whole length. Many much broader stems of *Lepidodendra* have occurred, but as they did not happen to lie in the direction of the workings, they could only be traced from side to side of the passages. This individual was thirty-nine feet in length, from the root to the first division into branches, the greatest breadth three feet, and gradually tapering; the ramifications of the branches extended to the coal



Magnified.

Pub. by Messrs. Ridgway London, July 1837.



SIGILLARIA FLEXUOSA.

From Killingworth Colliery, near Newcastle.

In many respects this is very like *S. reniformis*, from which, however, it differs in the presence of numerous, wavy, well defined lines, which apparently originate at the base of the leaves, and pass downwards, eventually losing themselves in the channels of the stem.

We have already expressed (*Vol. 1. p. 153.*) our opinion that Sigillarias are not the remains of Tree ferns. In a late number of his excellent *Histoire des Végétaux fossiles*, M. Adolphe Brongniart, defends with great acuteness and ingenuity the opinion that they were of that nature. To us, however, it still appears that the evidence is most defective and unsatisfactory, provided the genus Sigillaria is limited to the species with fluted stems: such as those which have been figured in this work. But if it is made to comprehend all

the scarred stems included in the genus by M. Brongniart, we in that case are quite ready to admit, that many (so called) *Sigillarias*, were either the rhizomata or trunks of Ferns.

LEPIDODENDRON OOCEPHALUM.

From Jarrow Colliery.

Apparently the fructification, in an incipient state, of a *Lepidodendron* allied to *L. selaginoides* and *acerosum*, but with more slender and longer leaves; the scale-like appearance upon the surface, is caused by the breaking off from their base of leaves similar to those shewn at the sides.



Fig. 1. Seed of R. Lyman, London, July 1887.



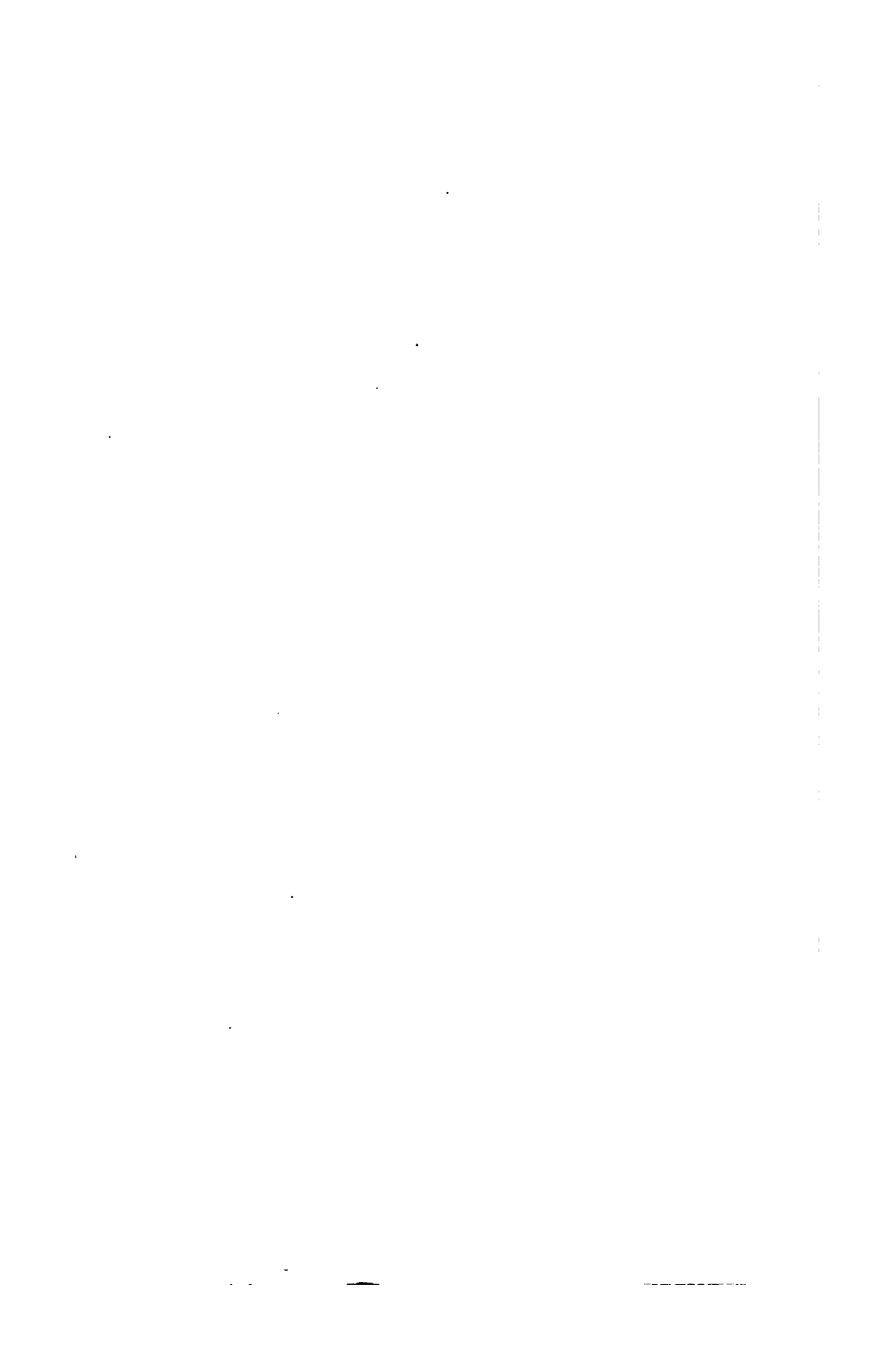
Pub. by Messrs. Ridgway, London, July 1837.

LEPIDODENDRON PLUMARIUM.



From Jarrow Colliery.

Whatever was the nature of the *Lepidodendron gracile*, figured at plate 9, the same it may be supposed was that of the species which forms the subject of the present figure. It consisted of a number of slender leaves, closely arranged over their stem, and curved upwards, like the plumes of a feather.



OTOPTERIS ACUMINATA;
var. BREVIFOLIA.

From the lower sandstone of Haiburn Wyke near Scarborough.

Mr. Williamson, Jun., to whom we are indebted for the drawing, observes that the leaflets are considerably shorter and less acuminate than those of the first *O. acuminata* ; they are also blunter. But these slight differences are no more than may be expected in different varieties of the same species.



Natural Size

W. C. Williamson, del.

Pub. by Messrs. Ridgway, London, July, 1837.



Natural Size.

SOLENITES? FURCATA.



From the lower sandstone of Haiburn Wyke near Scarborough; communicated by Mr. Williamson, Jun.

It occurs in the state here represented, the surface being marked by traces of delicate striæ. We place it in Solenites rather for the sake of giving the plant a station and a name, than because we have any reason for considering it of the same nature, further than its similarity of appearance.

OTOPTERIS OVALIS.

From the Oolitic formation of Gristhorpe Bay ; communicated by Mr. Williamson, Jun. who says, that two specimens only have been discovered, one of which was much smaller than that figured. Both specimens had a small short petiole, but they were not found attached to any thing. They are composed of a thin brown substance which may be removed from the shale with a penknife. Each leaf consists of a midrib passing through to the point, and of veins either simple or once forked, planted perpendicularly upon it.

It is probable that the specimens are leaflets of some compound leaf, and possibly of a new Otop-teris, to which genus we refer them.

CARPOLITHES ALATA.



Carpolithes alata. *Suprà vol. 2. t. 87.*




From Jarrow Colliery.

We presume this to be a more complete state of the fossil figured at plate 87 of the second volume of this book, and probably to be the same as the fig. 4. tab. 45. of Sternberg. In those specimens the shell has been broken and the interior laid open; here, on the contrary, we have a view of its external form, without however any additional information as to what it was.



A black and white photograph of a single, dark, elongated leaf with prominent parallel veins, resting on a light surface. The leaf is labeled 'A' at the top.

B



A black and white photograph of a dark, elongated, teardrop-shaped object, possibly a fossil or a piece of wood, mounted on a light-colored background. The object has a central longitudinal groove and a small notch at the bottom. It is labeled 'B' at the top.

Age Group	Education Level	Believe U.S. should take action (%)
18-29	High School	~45
	College	~55
	Graduate	~65
30-49	High School	~55
	College	~65
	Graduate	~75
50-69	High School	~65
	College	~75
	Graduate	~85
70+	High School	~75
	College	~85
	Graduate	~95





Pub. by Messrs. Ridgway, London, July, 1837.



Pub. by Messrs. Ridgway, London, July, 1837.

SPHENOPTERIS EXCELSA.

From the Newcastle Coal-field.

The specimens of this very beautiful fern are so imperfect, that we can neither ascertain what the margin was of the leaflets, nor the nature of their veins. It appears, however, to belong to the genus *Sphenopteris* in the neighbourhood of *S. Conwayi*, where it must stand until better evidence shall be produced as to its precise structure.



PECOPTERIS MARGINATA.

Pecopteris marginata, *Ad. Brongn. Hist. des Végét. foss.* 1. 291.
t. 87.

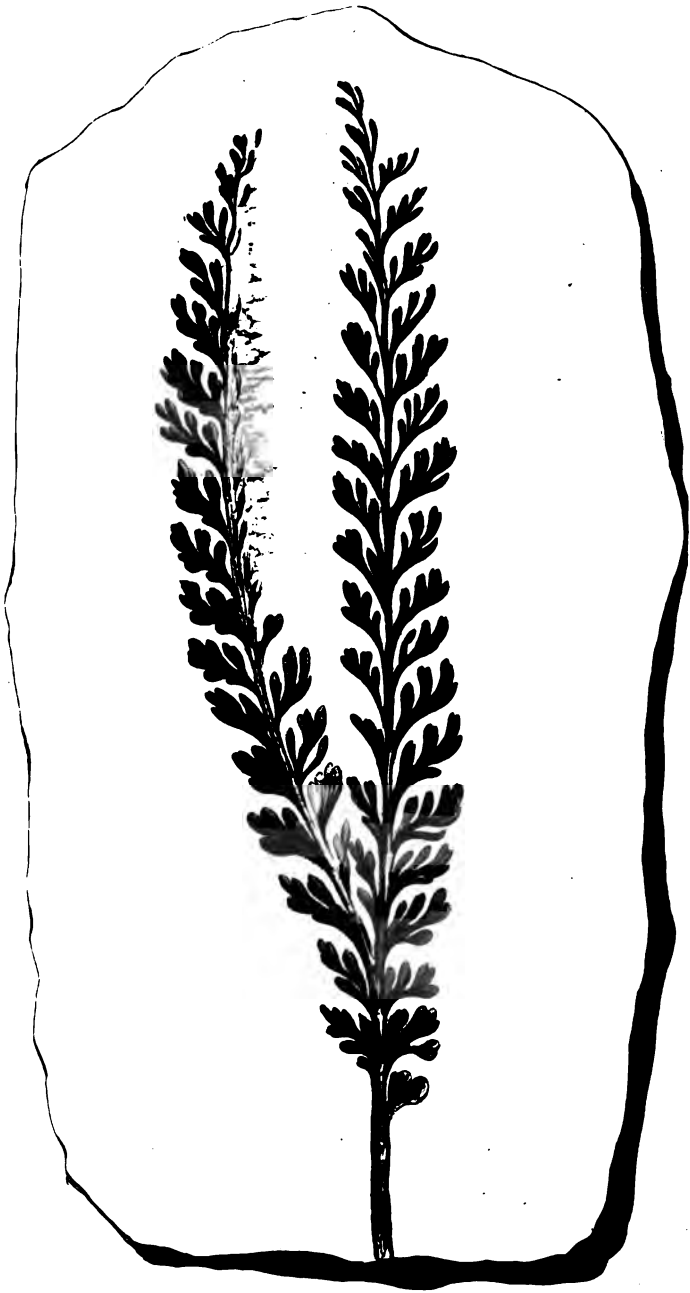
A fern of frequent occurrence in the Coal of the North of England.

What is here represented is a pinna of a bipinnatifid leaf; the pinnules seem to have been drawn a little together before the plant was fixed in the matrix, and there is every appearance of its having been some hard-leaved species.

M. Ad. Brongniart compares it with *Pteris biaurita*.



Pub. by Messrs Ridgway, London, July 1837.



SPHENOPTERIS CUNEOLATA.

From the Newcastle Coal-field.

The forked stem of this fern approximates it to *S. artemisiæfolia* and its allies, from which it is distinguished by the narrow, wedge-shaped, entire, or emarginate lobes of its leaves. In that respect it may be compared with *S. furcata*, but that plant has a regularly bipinnatifid leaf.

Not a trace of veins could be found in the specimen from which the drawing was made.



Pol. M. (Polypodium) M. (M. M.)



*Pinna of *Platanus*, from the *Platanus* fossil.*

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PECOPTERIS OREOPTERIDIS.

Pecopteris oreopteridis. *Ad. Brongn. Hist. des Végét. fossiles,*
1. p. 317. t. 105. f. 1, 2, 3.

One of the finest of the coal-measure ferns, and in all probability the remains of an arborescent species. Sent from Welbatch, near Shrewsbury, by the Rev. W. Corbett.

Its bipinnate character and its large size will prevent its being easily mistaken for anything except *P. polymorpha*, and from that species M. Ad. Brongniart well distinguishes it by the veins of the leaflets, which, here, are simple or only forked, and in the former plant dichotomous or twice forked.

CALAMITES APPROXIMATUS.

Calamites approximatus. *Adolphe Brongniart Hist.* 1. 133. t. 24.
t. 15. f. 7, 8.--*Artis Antediluv. Phytol.* t. 4.

The accompanying drawing was made from a beautiful specimen of this plant, nearly fifteen inches long and three inches and three-quarters wide, communicated by Professor Buckland from Camerton.

It agrees in a striking manner with the figures of *Artis* and *Adolphe Brongniart*, with the addition of a number of pits placed on the articulations, in a quincunical manner, as in *Calamites cruciatus*. Hence it is probable that the latter supposed species will require to be reduced to *C. approximatus*.



BOTHRODENDRON PUNCTATUM.

Bothrodendron punctatum. *Suprà vol. 2. tab. 80.*

It is not uncommon to find in the sandstone of the coal measures such bodies as that now represented: oblique flattened convexities, having a circular scar or two at their apex, and their sides indistinctly marked by depressed or elevated lines, losing themselves in the sandstone.

These bodies are the bases of the cones of Bothrodendron, and are already alluded to at Plate 80. To what is there said concerning them we find nothing to add. Such a cone as the one before us once fitted into the sockets shewn on the stem at Plate 80; its apparent apex is the base, its true apex is lost in the sandstone, and the scar at

the centre of its convexity is where it joined the trunk.

The specimen here represented was communicated by D. D. G. Lloyd, Esq. from Ketley, east of the Wrekin, a freestone quarry belonging to Lord Gower.

BRACHYPHYLLUM MAMMILLARE.

Brachyphyllum mammillare. *Suprà tab. 188.*

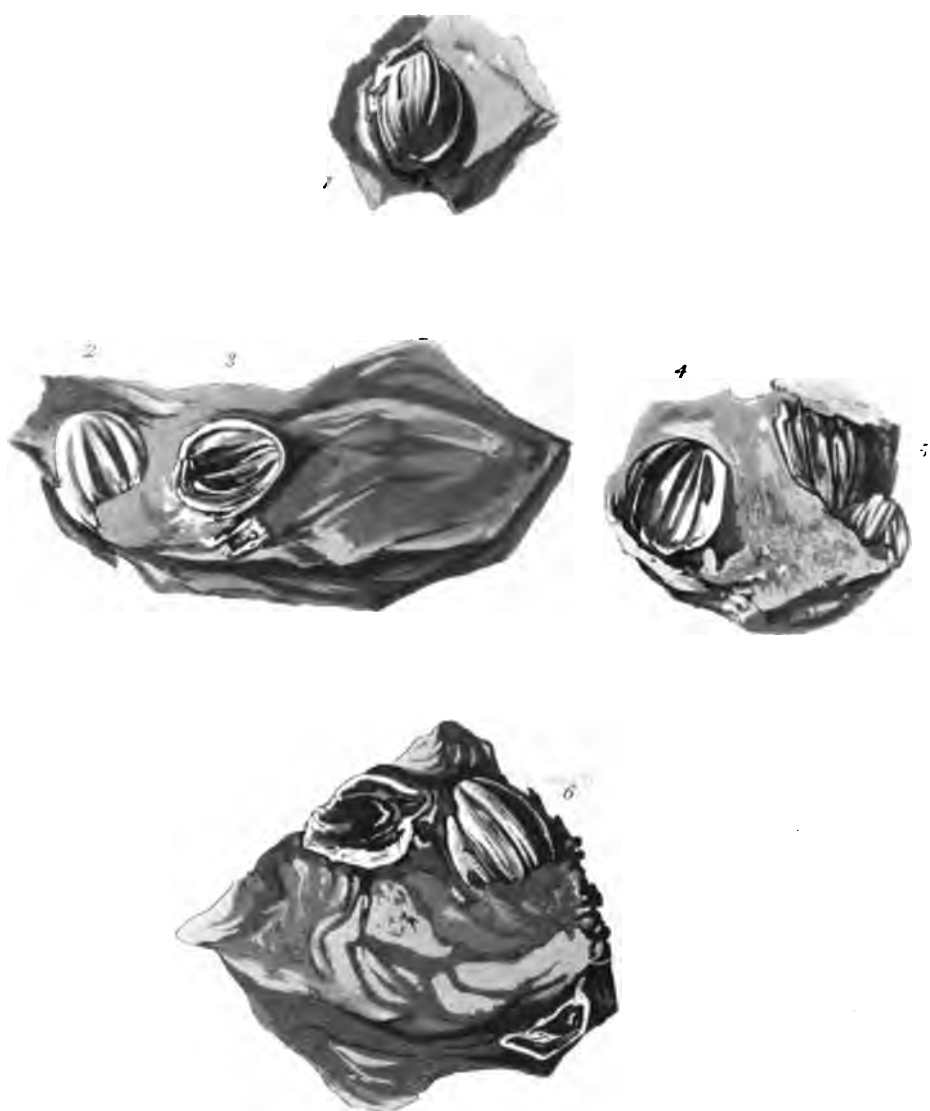
We have been induced to republish this plant in the hope that a second figure would convey a more correct idea of it than the first, in which the ends of the branches were represented too thick, and the points of the leaves in the magnified view too sharp, convex, and recurved. In some respects the present plate is more correct, but the magnified portion is made to resemble too much the surface of a *Lepidendron*, covered with lozenge-shaped scars.

In reality the fossil has its old branches closely covered with short, ovate, rather obtuse, appressed, ribless, scale-like leaves, which diminish in number as the branches diminish, till, without altering in

form, they become on the youngest twigs merely alternate. It should be compared with such recent Coniferous plants as are represented at t. 127 of this work.



Magnified.

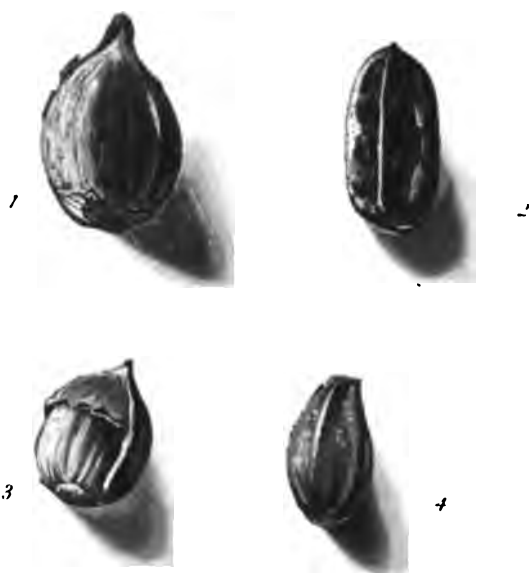


CARPOLITHES SULCATA.

In ironstone on Wardie Beach, near Newhaven,
found by the Lord Greenock.

This fruit may be thus described. Ovate, three-eighths of an inch wide, by five-eighths long, chalky white, tapering to the point, very slightly depressed at the base, with about ten deep furrows, which do not reach the base, apparently one-celled, with a thick pericarp.





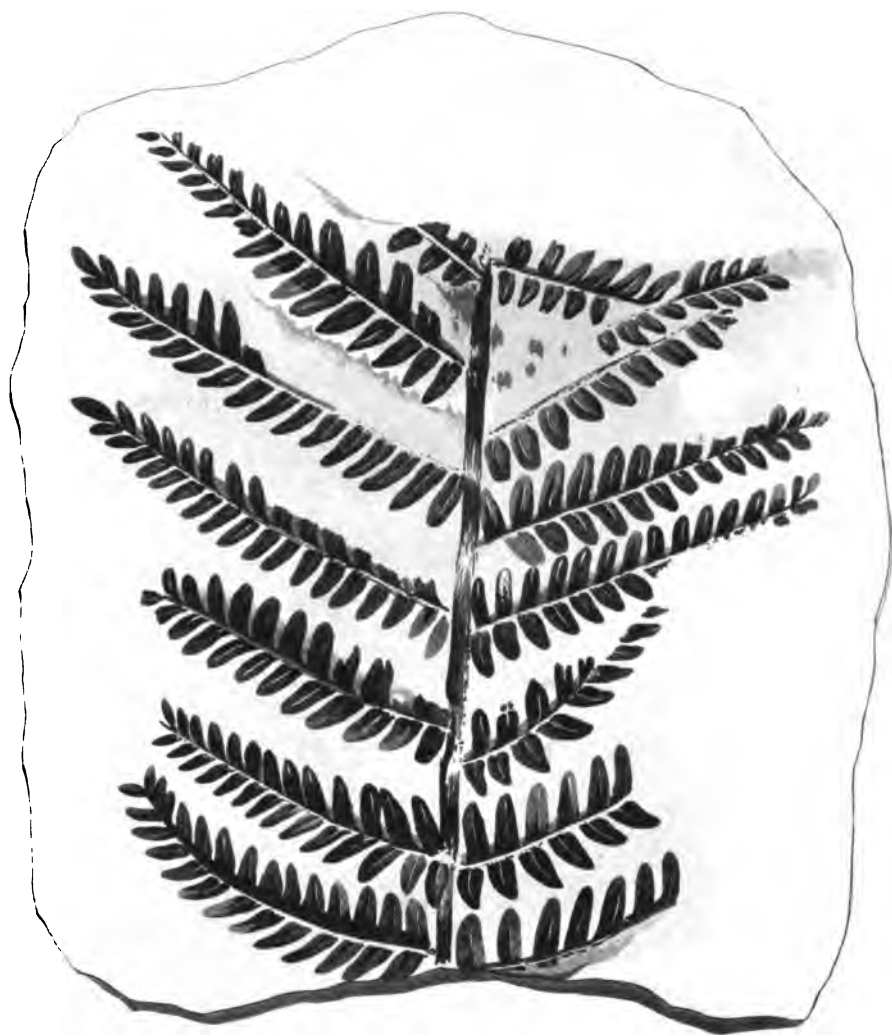
2. & 4. TRIGONOCARPUM NOEGGERATHI.

See Plate 193. B.

1. & 3. TRIGONOCARPUM OLIVÆFORME.

From Peel stone quarry, near Bolton. Mr. Dawes.

These are obviously Palm fruits (*see vol. 2. plate 142.*) *T. olivæforme* has only three angles instead of six, and is more ovate; otherwise it hardly differs from *T. Noeggerathi*.



Magnified



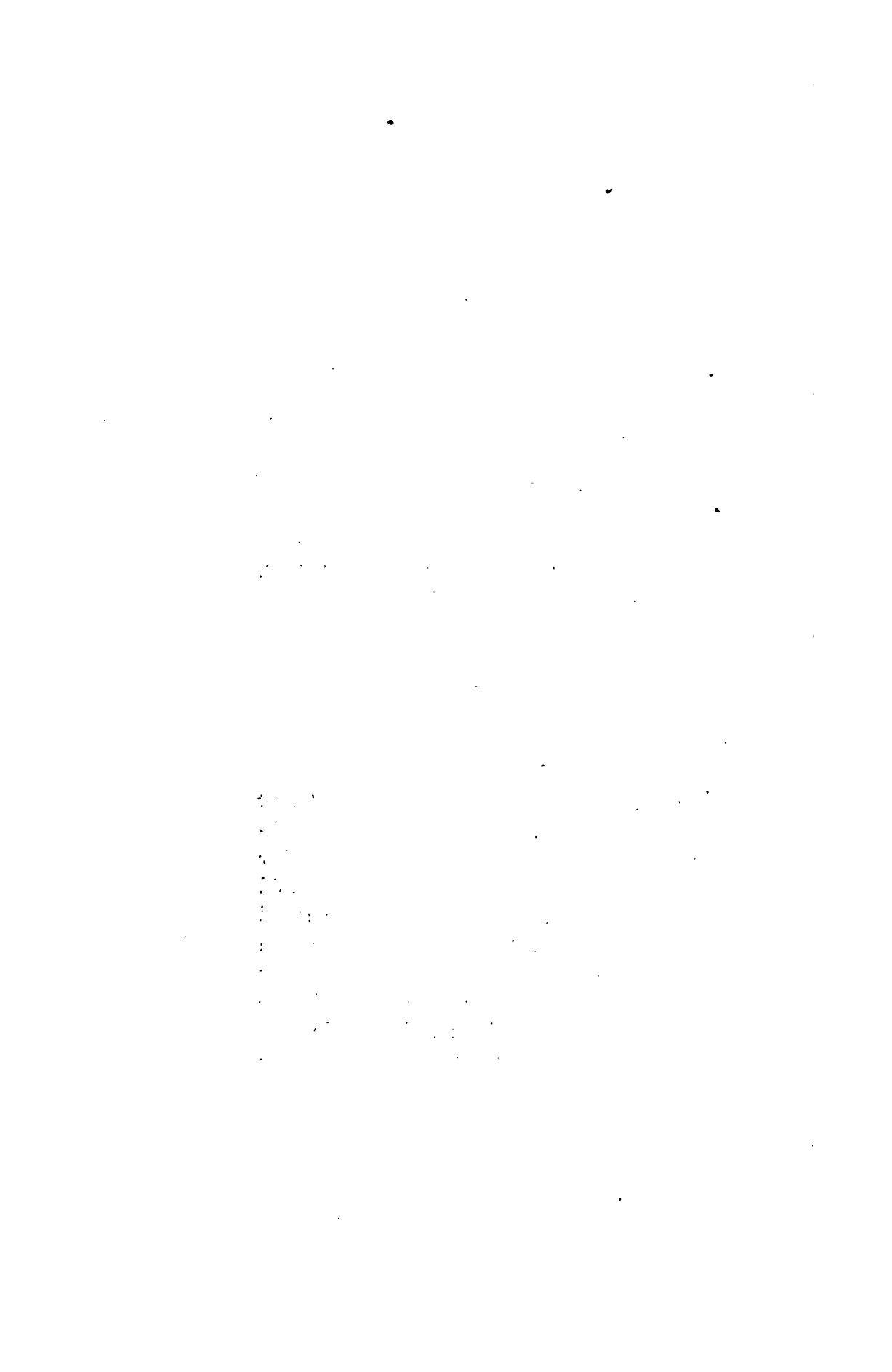
Trilobites, from the Devonian

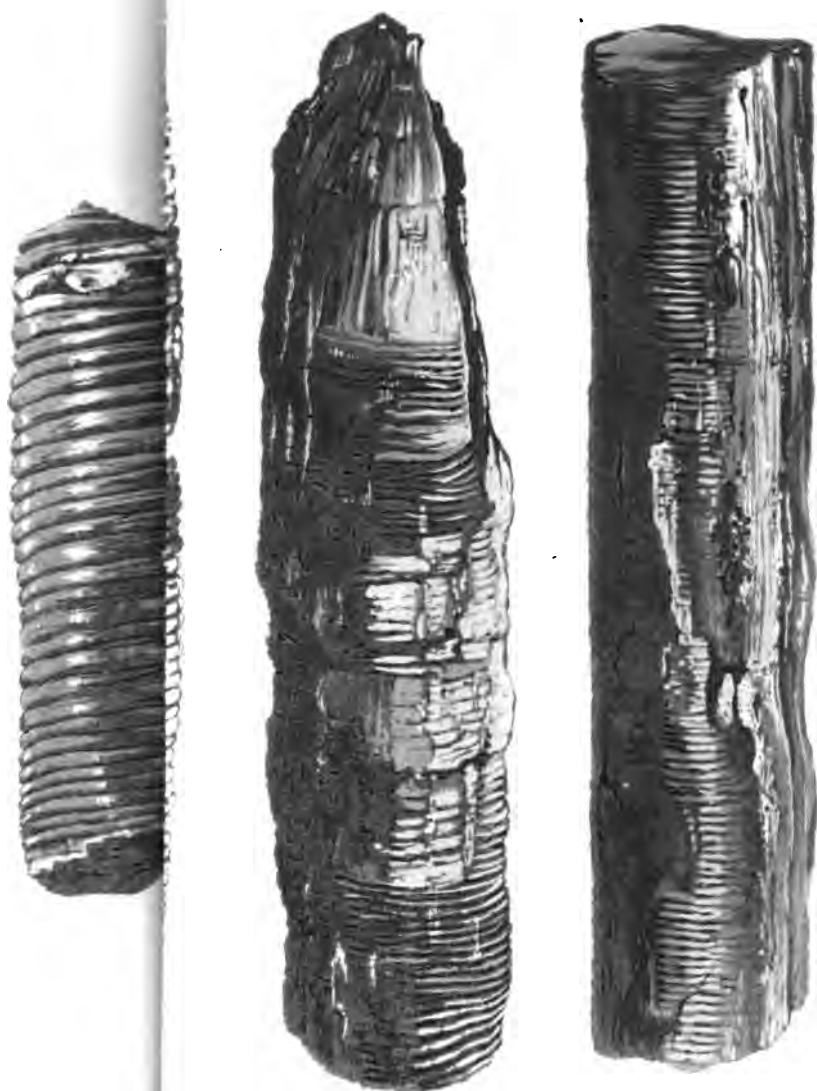
PECOPTERIS BUCKLANDII.

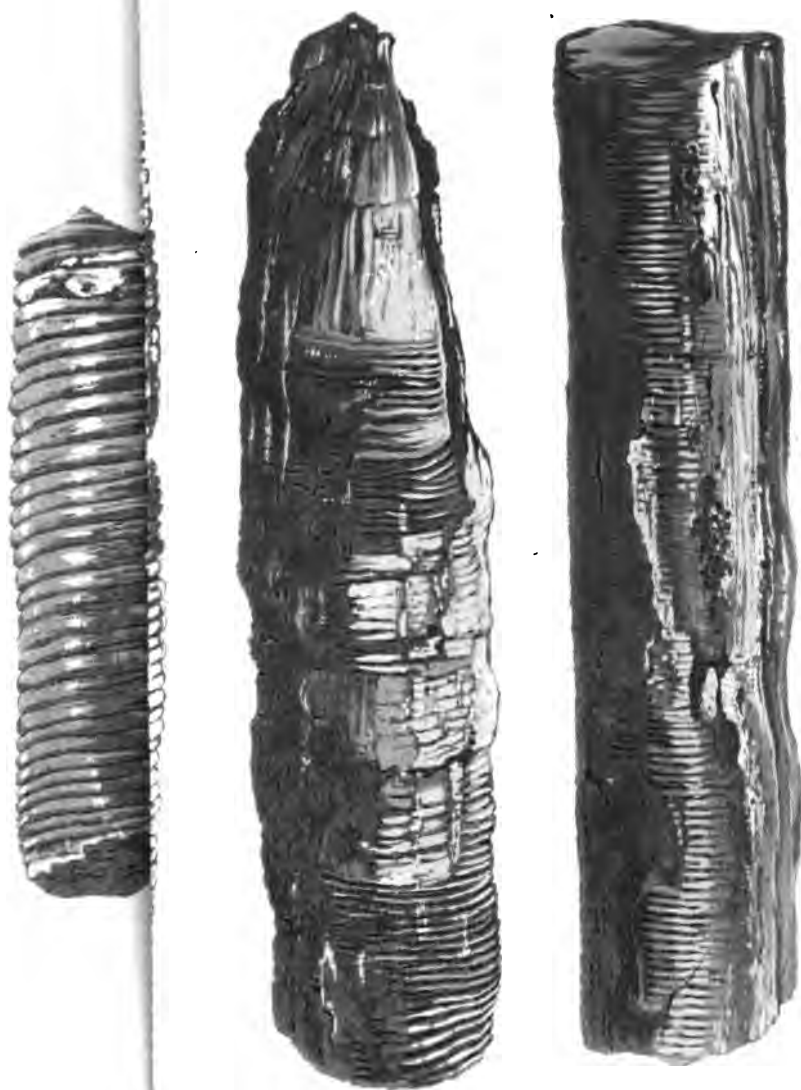
Pecopteris Bucklandii. *Ad. Brongn. Hist. des Végét. fossiles.* 1.
319. t. 99. f. 2.

From the Newcastle coal-field.

Our specimen is in the same state as that sent from Camerton to M. Brongniart by Dr. Buckland ; so that we are equally unable to say whether it is a species with a tripinnatifid or bipinnatifid leaf. It is, however, easily known by its small size, as compared with *P. oreopteridis*, &c. to which it approaches. M. Brongniart says that the very oblique direction of the veins, which are bifurcate near their base, and sometimes forked again near the top of their upper arm, constitutes a good distinguishing character.









STERNBERGIA APPROXIMATA.

Sternbergia angulosa. *Artis Antedil. phytol. t. 8.*

Sternbergia approximata. *Ad. Brongn. Prodr. p. 137.*

A most singular coal-measure plant, occurring in most of the coal-fields of this country, but not abundant any where. The specimens are usually found in sandstone, and are covered with fine coal, which either adheres in the form of an even thick glossy integument, or adheres in a powdery state to the surface of the stem.

The specimens figured in plate 225, are from Somersetshire and Newcastle; that in plate 224 is from Halliwell stone quarry near Bolton, from Mr. Dawes. They differ in size, in being more or less angular, and in the distance between their cross

bars ; but we see nothing to justify us in considering such characters as of specific importance.

When the integument of coal is broken off, these plants are sometimes found simply marked by horizontal depressed lines, which meet alternately from opposite sides anastomosing in the middle ; but in other cases the space between the lines is excavated into deep furrows, and honey-combed as it were by the formation of short perpendicular bars which connect the lines ; traces also may be found of lines running along the sides of the stem for a considerable distance. The result of this is that many stems appear as if they were composed of horizontal plates, about 1-16th of an inch apart and held together by some connection in the axis of the stem : a most extraordinary appearance, to which we know of no parallel, and which we are by no means prepared to say is their real structure.

M. Adolphe Brongniart regards such stems as analogous to those of *Yucca* or *Dracæna*, considering the horizontal lines as the stations of leaves which have fallen off. We regret to say that we have no evidence to produce either in confirmation or refutation of this opinion, beyond what the plates and the above remarks afford.

ZAMIA OVATA.

We received this beautiful and unique specimen from W. Richardson, Esq., F.G.S. who found it upon the coast of Kent, near Feversham. The surface of the land in and about that place is covered with bouldered Green-sand fossils, to which this also belongs.

It is evidently of the same nature as the cone figured at plate 125 of this work, but appears to be distinguished specifically by the ends of the scales being acute or nearly so, and not truncate, and by the ovate form of the cone itself. The specimen is much rolled; but whether these differences can be assigned to that circumstance must be shewn by further evidence.

It is not a little curious that the only two *Zamia* cones yet found in the Green-sand should both have been partially devoured on one side. Here the figure A: 2. shews that the whole interior of the cone

is laid open on one side, as in Professor Henslow's specimen of *Zamia macrocephala*.

The cone is broken off at the bottom, and was therefore longer than what is figured ; but it is probable that the fracture has taken place near the base.

STROBILITES WOODWARDI.



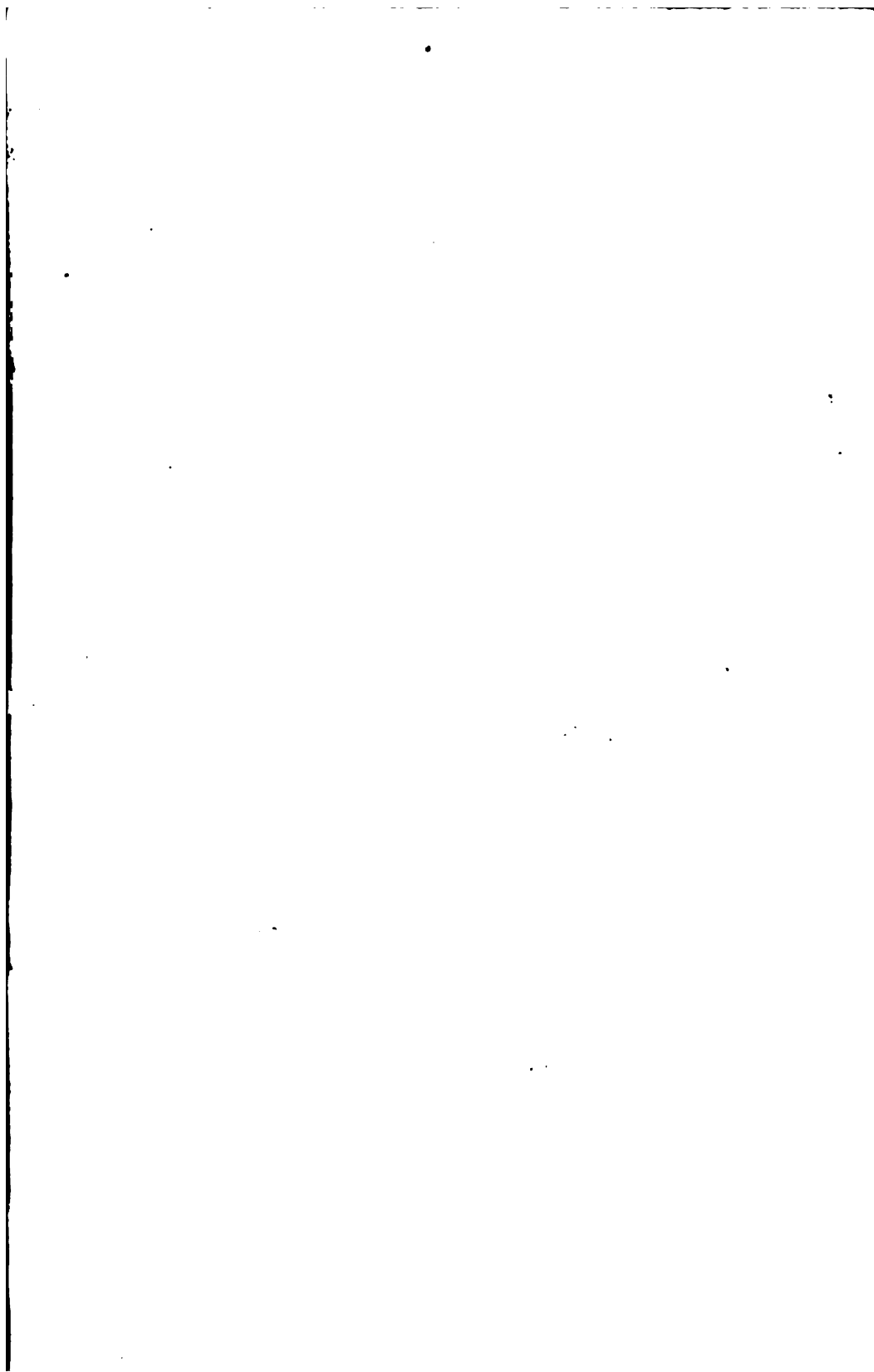
Communicated by Mr. Woodward of Norwich with the following note.

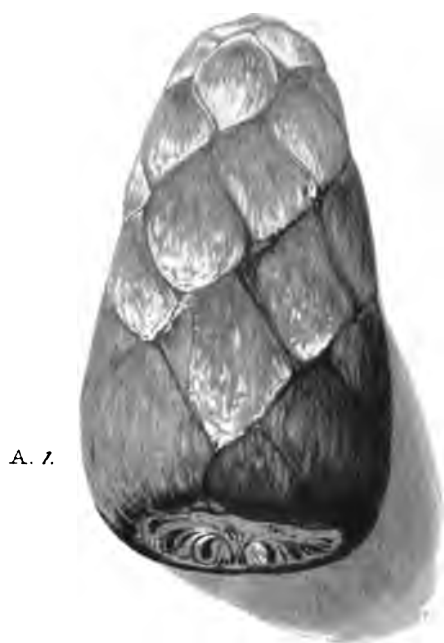
"The strobilus, originally three inches long, was found in a layer of decayed wood and vegetable matter at the base of Paston Hill, near Mundesley, a portion of the line of the Norfolk cliffs. It is seen in numerous other places in the cliffs between Hasboro and Cromer, and consists of wood, bark, leaves, seed-vessels, &c. an accumulation similar to those seen on the surface of a plantation. I consider this layer to be the remains of the forest trees of the antediluvian period, as, above it, are in some places 10 feet, in others more than one hundred feet, of diluvial debris. And although there may be some similarity in the appearance between these remains and those found in the forming of the Dilham canal, about four miles inland from the line of these cliffs, still it is

evident from the nature of the remains in that locality that they are lacustrine, and of the post-diluvian period."

The cone is in the state of half charred wood, or rather in that of wood met with in the brown coal formation; and has a strong woody centre, round which are loosely arranged a considerable number of woody scales as in the cone of the European Larch. The scales are so much broken that their original form cannot be ascertained with certainty; it is probable, however, that they were entire, rounded, rather oblate, and thinned off to the edge, as in the genus *Larix*.

Possibly this may be referable to the genus *Voltzia*, of which all the species hitherto discovered are from the new Red Sandstone, or *Grès bigarré*.





A. 1.



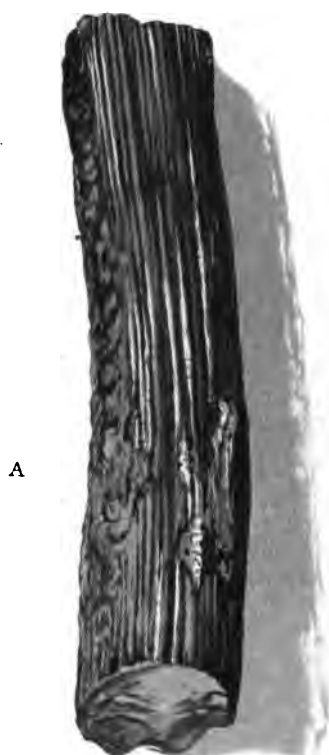
A. 2.

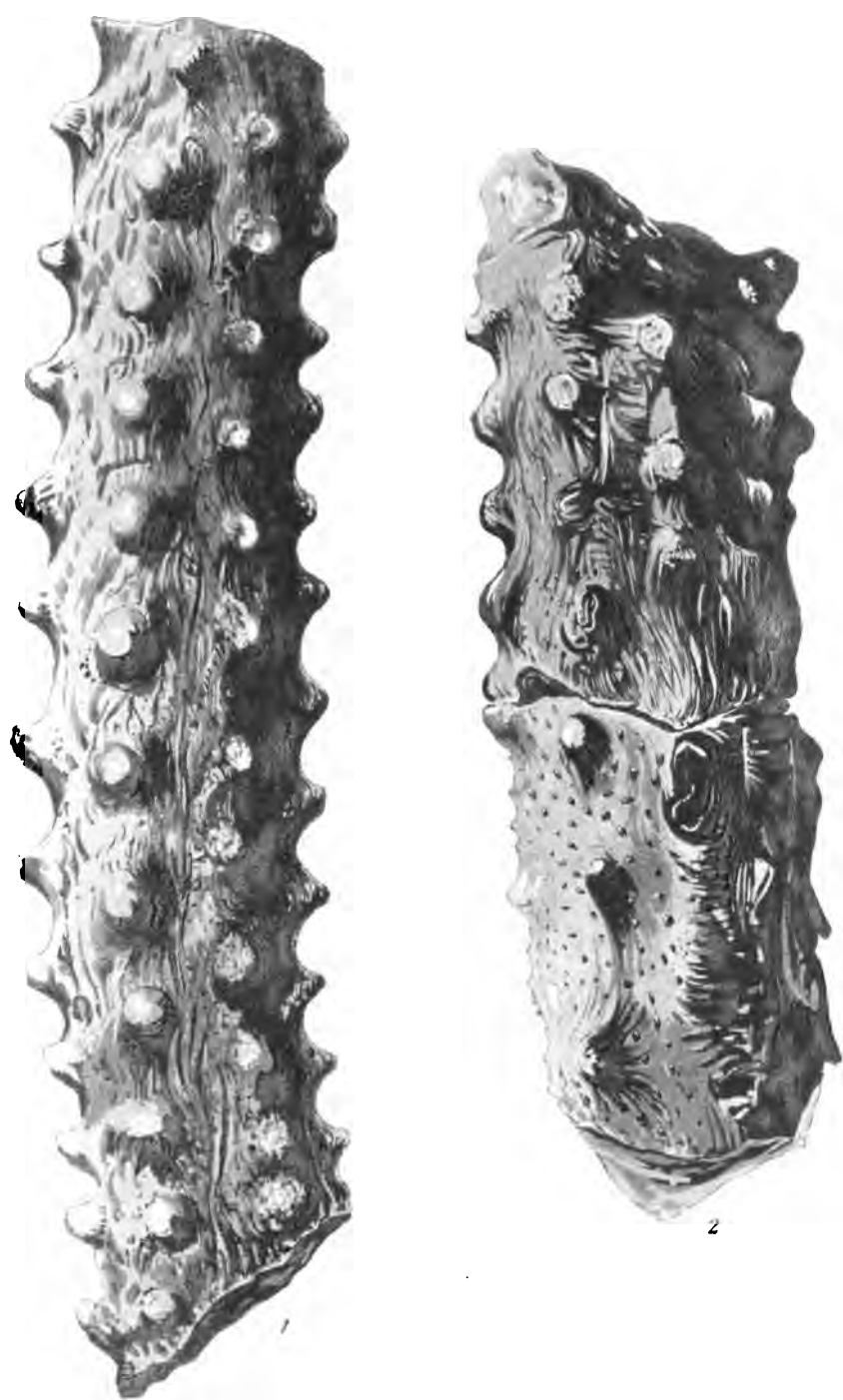


B. 1.



B. 2.





HALONIA REGULARIS.



Fig. 1. from Halliwell stone quarry near Bolton ;
fig. 2. from Peel stone quarry near Bolton ; both
communicated by Mr. Dawes.

These are most remarkable specimens of this
curious genus. They are quite distinct both in
dimensions, and in the regularity with which their
tubercles are arranged, from either of the species
previously figured.

FILICITES SCOLOPENDRIOIDES.

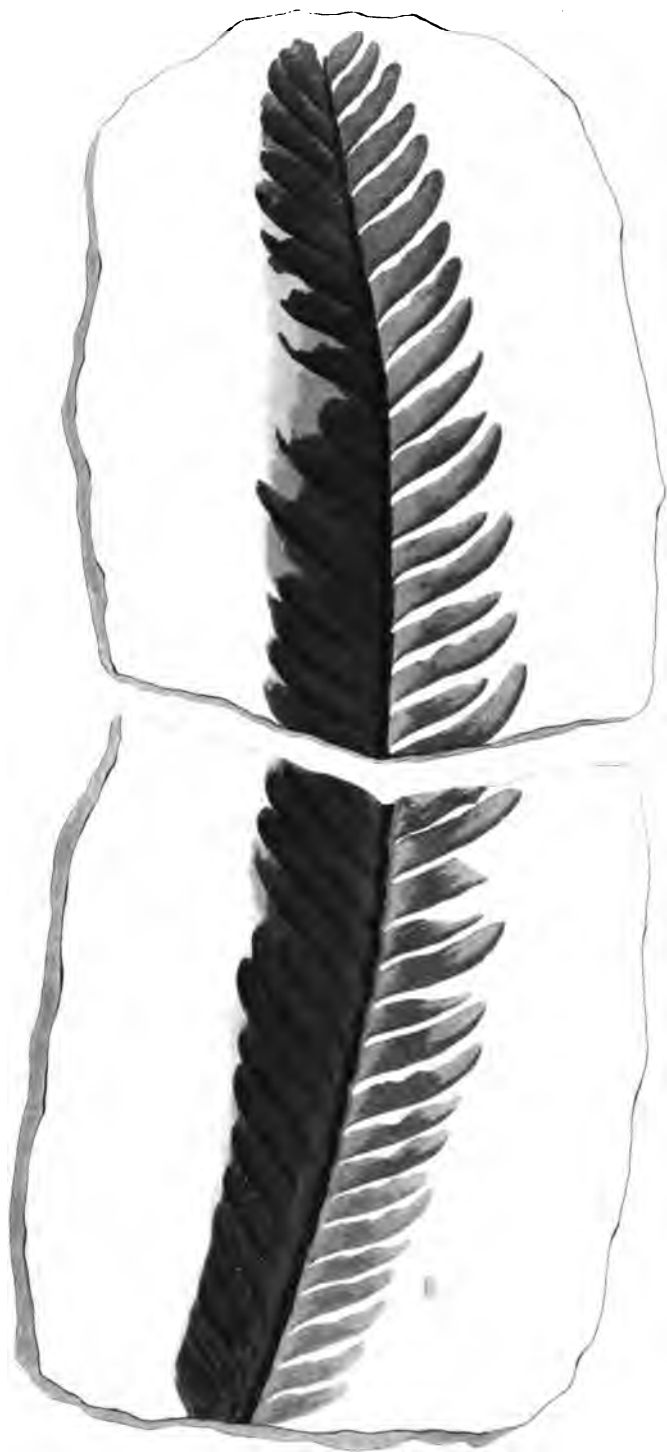
Filicites scolopendrioides. *Ad. Brongn. Ann. des sc. nat. xvi.*
443. t. 18. f. 2. Histoire des Vég. foss. 1. 388. t. 137. f. 2.

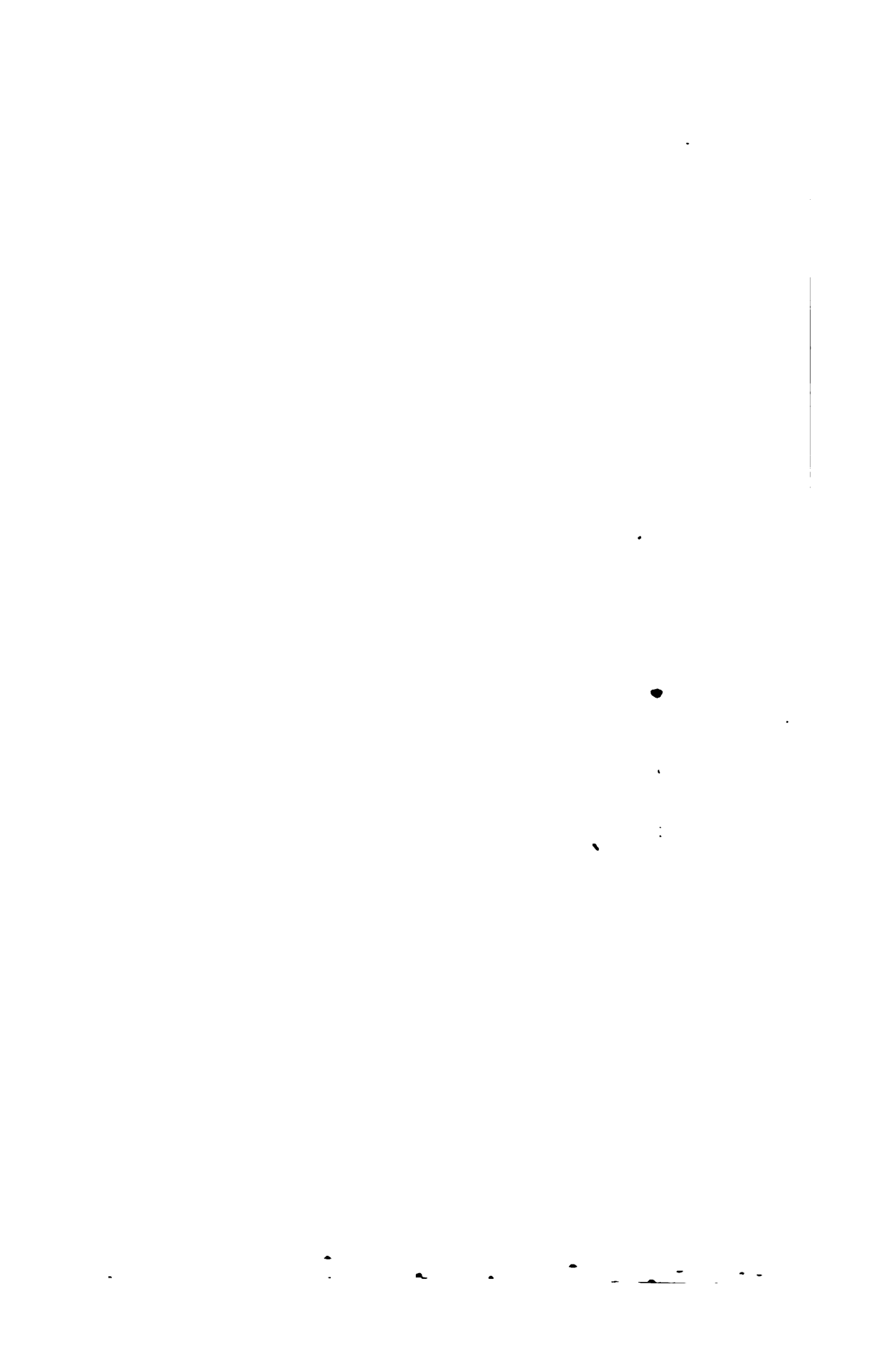
The specimen figured by M. Adolphe Brongniart under this name from the Grès bigarré of Sultz-les-Bains is in a state of fructification. That from which our plate has been taken was barren; we received it from Mr. J. S. Bowerbank, who procured it from the New Red Sandstone near Whitby. It was so long that we can only shew the upper and lower extremities, and is chiefly interesting as proving that the principal distinction between the barren and fertile pinnæ of the plant consists in the former being adherent to the rachis by their whole base, slightly falcate and obtuse,

as is represented in M. Brongniart's figure at the bottom.

No evidence concerning the veins was afforded by Mr. Bowerbank's specimen ; but it proved most distinctly that the leaf was not simple as M. Brongniart supposes, with parallel simple oblique rows of fructification, but pinnated, with the upper pinnæ covered all over their back with fructification. The barren pinnæ either occupied only the lower part of the leaf, or, as in the specimen before us, constituted the whole leaf, as in the modern *Acrosticha aureum* and *inæquale*.

We consider this plant nearly allied to the Indian *Acrostichum Wightianum*.





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Magnified

SPHENOPTERIS LINEARIS.

Sphenopteris linearis. Sternb. *Fl.* t. 42. f. 4. *Ad. Brongn.*
Hist. des. Végét. fossiles, 1. 175. t. 54. fig. 1.

Found by Count Sternberg in the Bohemian Coal-field, and by Dr. Hibbert and others in that of the North of England.

The broad wedge-shaped pinnules, with truncated lobes, which have pretty generally two or three shallow crenatures at their end, together with a compactness of growth not common in the genus, mark this species at first sight.

The plant figured at plate 181 under the name of *Sp. furcata* is too near this. The true *Sp. furcata* is more divaricated with longer and narrower lobes to its pinnules.

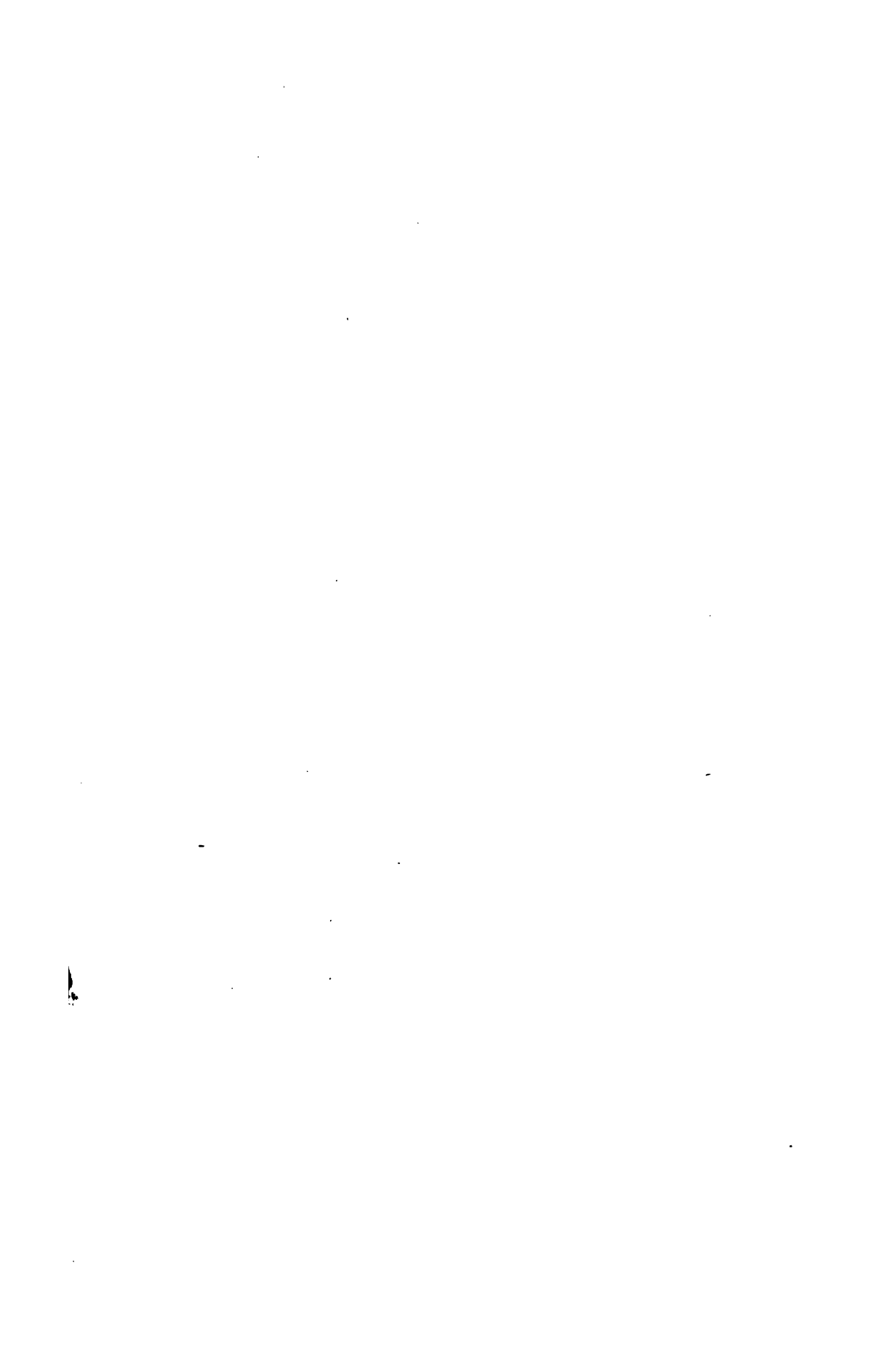
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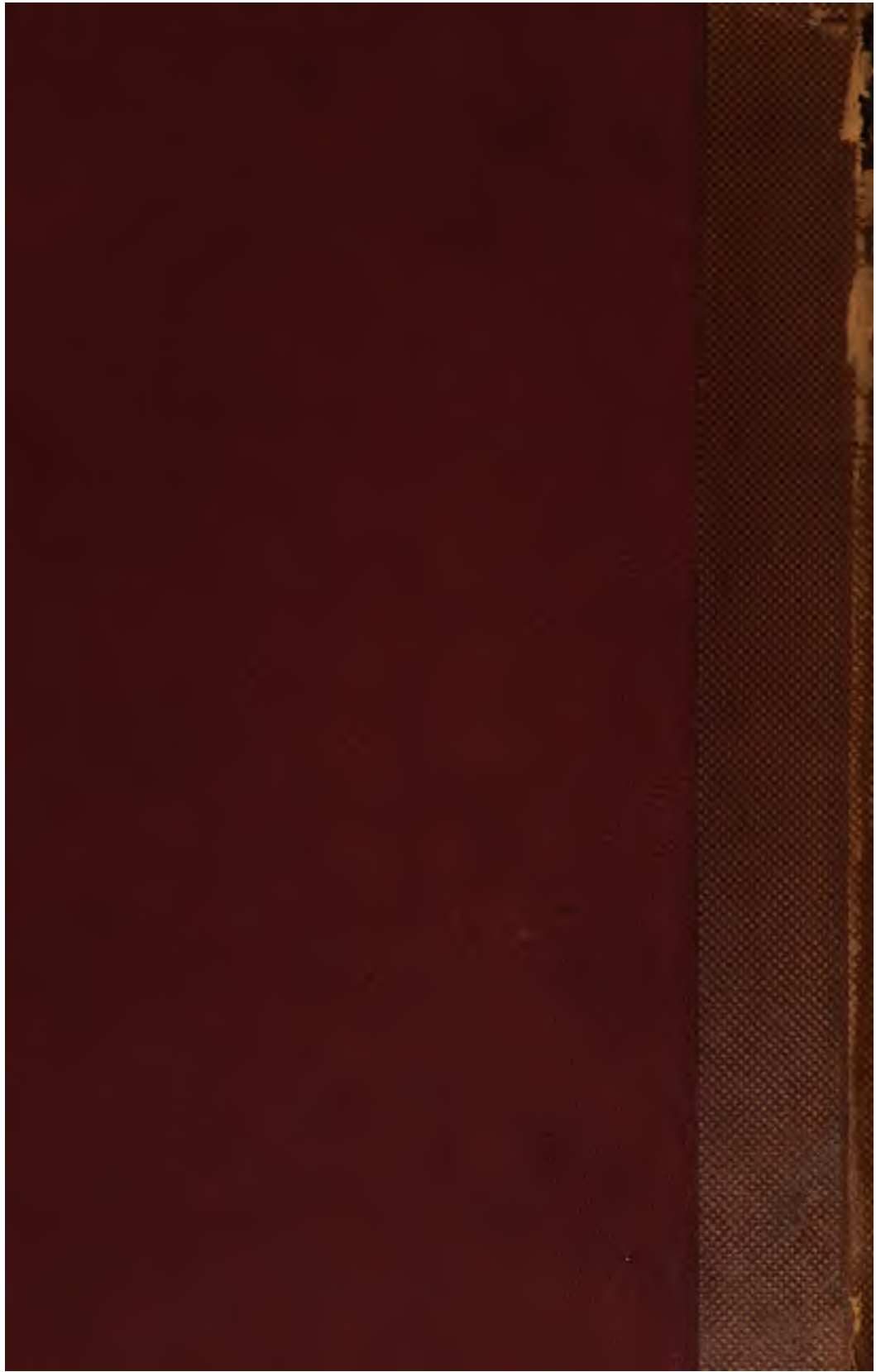
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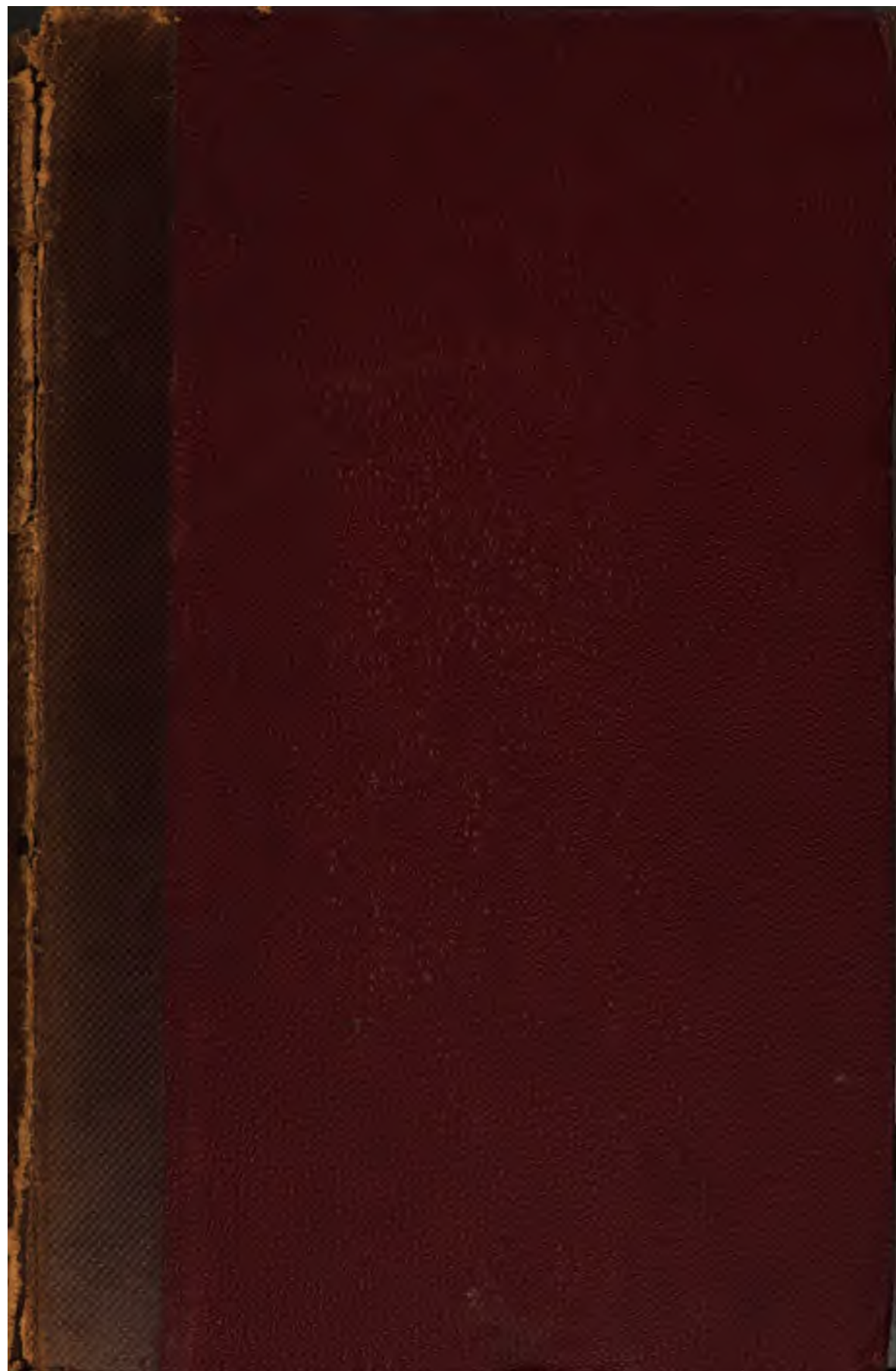
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PREFACE

TO

VOLUME II.

It was a part of the plan laid down when we commenced this work, to take the opportunity afforded by the appearance of each succeeding volume, to state such general opinions as we might be led to entertain on the subjects embraced; accordingly, it is our intention at the present time to detail some views we have been induced to take of the circumstances under which the vegetable fossils of the Carboniferous formation have been deposited and mineralized, together with a general sketch of the rocks comprised in the term "Coal Measures;" in the structure and composition of which, vegetable remains form so important a part, as to give an economical value to them, far surpassing any other. In doing this, we beg it may be held in view by our readers, that our references will be made exclusively to

VOL. II.

b

the great Coal field of the North of England. We have several reasons for limiting ourselves, in the present article, to this district; the first is, it has been far more extensively worked, and its productions are, consequently, better known than any other. It has, also, furnished us with a very large portion of the materials we have hitherto made use of; and the residence of one of the Authors in the midst of it, has necessarily brought the circumstances attending it more particularly under our notice. There is a convenience, also, in thus limiting our references, as our observations cannot occupy a large space; besides which, we are convinced, that, in every essential circumstance, the history of one series of Coal measures is the history of every other of the same age.

It was our wish to have appended to this a Catalogue of all the vegetable fossils hitherto discovered in it; but, in attempting to form one, we have immersed ourselves in a labyrinth of difficulties, one half of its fossils having never been described; and, although we could easily ally a portion of these to known genera, yet the greater number of them would remain absolute riddles—waiting for some fortunate discovery by which they are to be connected with fossils already known, or proved to belong to others yet to be discovered.

The beds usually denominated the Coal measures, being the higher part of the Carboniferous

formation, occupy a large portion of the Counties of Northumberland and Durham, reposing upon, and being conformable to, the inferior members of the series. They consist of irregularly alternating beds of sandstone, shale, or argillaceous schist, and coal, whose aggregate thickness may be estimated at 300 fathoms. This may not be correct, but is, probably, near enough the truth for our purpose.

With the exception of the coal itself, and a few layers and nodules of clay-iron-stone, embedded in some of the shales, the whole of these beds are of mechanical origin, the shale being evidently laminated clay, or mud, consolidated by pressure; and the sandstones abraded Quartz, Felspar, and Mica, agglutinated by an argillaceous or calcareous cement. From whence the immense mass of travelled matter, of which these sandstone and shale beds are composed, may have come, it is somewhat difficult to conjecture. The sandstones of the series below the Coal measures, denominated millstone grit, contain interspersed masses of water-worn quartz, of considerable size; and rarely amongst those of the Coal-formation, a bed will be found, partaking of the same characters; but the mass consists of minute siliceous grains, which are not rounded, or but partly so; from which it is fair to infer, that, whatever were its origin, the sand of which they are composed was not brought from any great dis-

tance, or formed like the sands of our sea-shore, by the slow action of attrition upon rocks previously consolidated, but that it had, probably, been produced by the ruin of crystalline rocks, so slightly coherent, as to have been unable to withstand the violent action of water, to which they had been exposed. The sandstones are all, more or less, micaceous, some of them containing that mineral in large quantity; where this is the case, and the plates are of considerable size, the stone is finely schistose. This is another proof that the materials forming the sandstone, had undergone little mechanical action previous to deposition, or the fragile mica would have disappeared.

In the series of beds, the coal itself forms, in bulk, a very inconsiderable portion of the whole. Forty seams are enumerated, but the greater part of them are too thin to be worked to profit.

The district has long been famous for producing coal of the finest quality, which has been extensively worked, and, up to the present period, the largest mining speculations in the kingdom, and, probably, in the world, are carried on within it. This being the case, it has become a matter of great economical importance, to define, as nearly as possible, each separate bed in the series, and this has been done with great minuteness. It is the universal belief of those best practically acquainted with the subject, that even the thinner

beds of coal, when not cut off by the rise of the strata to the surface, or by some fault, are spread out over the whole area of the formation. Whether this be the case or not with all the seams, we shall not stop to enquire; but the two beds known as the High and Low Main Seams, from their not only being the thickest, but as affording, in their whole mass, coal of fine quality, have been worked for centuries, and are known over a space, in the first instance, of more than 80, and in the second, of 200 miles square.

In studying the Carboniferous formation generally, with reference to the circumstances under which its different members have been deposited, nothing is more singular than the sudden change in the nature of the beds composing it, and the clearly defined line by which these beds are separated from each other; this is most particularly striking in the lower portion, where a thick stratum of Carbonate of Lime will be seen to terminate abruptly, and be immediately succeeded by a bed of entirely mechanical origin, and of a composition so opposite, as to contain scarcely any calcareous matter whatever. Nor is the difference of the nature of the two beds more striking, than the difference of their imbedded organic remains; whilst those of the limestone are almost exclusively of marine animals, the sandstones very rarely contain fossils at all; and these, when pre-

sent, are, in a majority of cases, terrestrial vegetables.

The Carboniferous formation presents, from the lowest to the highest member, a series of the same vegetable forms. In the sandstone beds, immediately succeeding the Old Red Conglomerate, which occurs at the base of the formation, along the line of the great Cross Fell fault, *Sigillaria*, *Lepidodendron*, *Calamites*, and *Stigmaria*, begin to make their appearance; as we ascend, the vegetable remains increase, whilst those of marine animals, which existed in the limestone and shale in profusion, decrease, until we arrive at the Coal formation proper, where marine remains disappear, giving place to those of vegetables alone.

In this part of the series, we have the remains of plants in every bed; the sandstones contain them, but, from the roughness of their mechanical composition, it is the larger and stronger stems only which have left their forms impressed upon rocks of this class. Coal itself very rarely retains any outward marks of its vegetable origin, but the shale bed, immediately over the coal, (when that substance forms the covering, as it usually does,) furnishes us with fossils in the greatest abundance. These are exposed by the operations of the miner, who, in removing the coal, often brings to light vegetable forms of sin-

gular beauty and variety, which are almost invariably found parallel to the laminæ of the stone, and pressed flat, their outward form being retained on the shale as it was taken by the soft mud which sealed them up, their substance being converted into coal. Very large stems are often found standing across the strata, and penetrating through several different beds.

The vegetable origin of coal is now universally conceded; and it is almost as universally believed, that the plants, of the remains of which it is composed, were swept by torrents from some neighbouring high and dry land, into lakes and estuaries, where, becoming saturated with moisture, and loaded with sand and mud, they sank to the bottom, and there reposed upon previously deposited beds of sand and mud; another vegetable mass being in turn washed off, and buried by successive deposits of these substances, to be followed, in due time, by another, and another.

Associated with the seams of coal, and in the beds immediately surrounding them, stems of *Sigillaria*, of a large size, are frequently found standing erect, with their roots proceeding from them on all sides, (see vol. 1. plate 54.) We are aware that the evidence of plants in this position having grown on the spots where we now find their remains, is not complete if taken alone, as it has been argued they have been floated from a distance, and left standing in an upright position

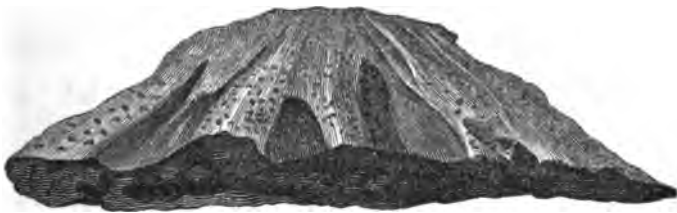
by the force of gravity, as is known occasionally to be the case during floods, where trees are removed along with the soil in which they grew; and this seems to have been certainly the case with the upright stems in the sandstone of the French mine of St. Étienne, where the different levels of their roots prove, as M. Constant Prévost has already remarked (*Dict. des Sc. art. Terrain*), that they could not have grown where they now stand; but in the Lias Cliffs near Whitby, where the fragile stems of *Equisetum columnare* occur perpendicularly, they cannot have been so placed by force of gravity; and if evidence the most conclusive be required of the fact of vegetables having sometimes been overwhelmed on the spots where they grew during the deposition of the strata, it is furnished by the Fossil Forest of what is called the "Dirt bed," immediately over the fine building-stone of the Island of Portland; and sub-marine forests of the present day supply us with the same fact, connected with a different order of things.

The fossils of the Coal measures occur often in groups; thus in the roof of the coal in Felling Colliery, the remains of *Pecopteris heterophylla*, (see vol. 1. plate 38,) were, a few years ago, most abundant; they occurred alone, almost unmixed with any other, over a considerable space, but, beyond that have been rarely found, so that they are now comparatively scarce. Could such grouping have taken place if the individuals had been swept from a distance?

In plate 31, vol. 1, we figured a nearly perfect specimen of *Stigmaria ficoides*, which was found, with two others, almost as perfect, in the shale forming the covering of the coal, in the Bensham seam, Jarrow Colliery, at the depth of about 200 fathoms from the surface; since that period, 14 others have occurred, all in the same bed, and within a space of about 600 yards square.*

Two of the specimens above alluded to, have been recently removed from the mine; one is the impression of the under side of the plant, shewing the central concavity, and 15 arms proceeding from it, four of which are distinctly branched; they are all truncated, the longest being four feet and a half.

The other specimen, of which the following is a sketch—



is of much smaller dimensions; and, in this case, fortunately, the fossil has detached itself from the

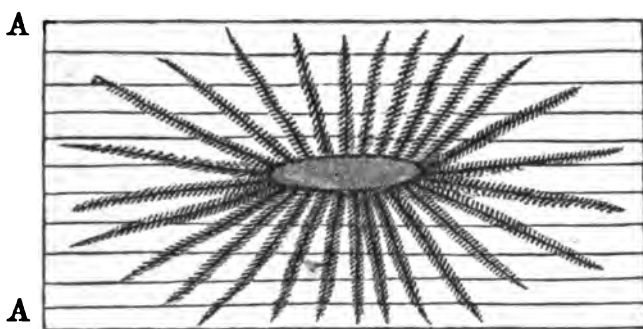
* That a proper idea may be formed of the abundance in which the remains of *Stigmaria* occur in this bed, it should be stated, that those alluded to above, have all been brought to

roof, thus affording an opportunity of examining the upper surface of the central portion, which none of the before cited instances did. This exhibits the same wrinkled appearance, with indistinct circular spots, as the under side described vol. 1, page 104 ; it has nine arms, five of which sub-divide into two branches, at about 18 inches from the centre of the fossil, and one at three feet : in this, as in the other instance, they are all broken off short. This fossil, as before observed, occurred in the bed of shale immediately over the coal, towards which all the branches slanted. Two of these, which were longer than the others, were seen to reach the coal, where they were lost in the mass ; whether the others had done so or not, could not be ascertained.

It would be out of place here, to recapitulate what has been already said of the form and nature of this strange fossil ; but we must be allowed to observe, that the opportunities of further examination afforded by these several specimens, have proved that the centre was a continuous homogeneous cup, or dome, and not the remains of the

light in a short period, by the working of the mine ; and that only in the roof of the passages, as from the mode of operation rendered necessary by the nature of the bed above the coal, at the first working, two-thirds of that substance is left standing for its support ; when this coal is afterwards removed, the roof will fall, so that it may never be possible to ascertain how many of these fossils now remain covered up.

arms squeezed into a single mass, as we formerly surmised it might be. We have, also, been furnished with the most convincing evidence of the leaves proceeding from the stem in all directions, thus:—



(A) Layers of Shale

and, although we must still suppose the great length assigned to the leaves by that intelligent observer, Mr. Steinhauer, of 20 feet, to have originated in some error of observation, it gives us pleasure thus further to confirm the views originally taken by him, of this singular tribe of plants; we have, ourselves, seen the leaves well defined, three feet long.

Could it be possible for these plants, of a yielding fleshy substance, with numerous arms proceeding on all sides from a central dome, to be floated from the dry land, and buried in the mud

of an estuary, without being broken and squeezed—the extent of the out-stretched arms, when perfect, having been at least 20 to 30 feet? If they had been so floated, they must of necessity, in sinking down upon the muddy surface, have become flattened, and could not have presented the convex form we now find them invariably in. The leaves, also, which thickly surrounded the arms, could not, under any circumstances, even supposing them to have been hard woody spines, (which they assuredly were not,) have taken the direction in which we now find them, proceeding from the stem on all sides at right angles to its axis, and penetrating the shale, even perpendicularly up and down, to the extent of two or three feet, at least; had the plants been floated, the leaves, on the contrary, must of necessity have been pressed upon the arms, surrounding which we should have found their remains, in confused masses, and spread out irregularly by their side, in the plane of the surface on which the plant had finally reposed; none of this, however, takes place; but, on the contrary, when the shale is split, so as to expose the surface of the fossil, the leaves are seen proceeding, with the greatest regularity, each from its separate tubercle, those only being distinct in the length and breadth, which, when in a growing state, had been shot out in the plane which is now the cleavage of the shale. (See plates 32 and 33, vol. 1.)

From all these circumstances, we are compelled to conclude, that these *Stigmaria* were not floated from a distance, but that, on the contrary, they grew on the spots where we now find their remains, in the soft mud, most likely, of still and shallow water. It is worthy of observation, that the fossil remains of a *Unio*, (undescribed,) occur, in considerable abundance, associated with the *Stigmaria*, but, in a shale, which forms the covering of the high main coal in the same colliery; and about 45 fathoms above the *Stigmaria* bed, as we may very appropriately designate it, there is, in one spot, a considerable accumulation of this same fossil *Unio*; the coal has been worked out under the layer of shells, in all directions, and they are found to cover an area of 5000 square feet. The shells are partly embedded in the coal itself, (which is spoiled by them,) and partly in the shale above it; the bed is about 18 inches thick; the animals have, evidently, died at various ages; and the shells, of all sizes, are, many of them, gaping open. As it is impossible to conceive these, consisting of one species only, to have been brought from a distance, and deposited here, we must conclude, that this bed of shells, (and there are many more known in other parts of the series,) marks what had been, for some considerable period, as compared with the age of man, the uppermost surface of the earth, upon which fresh, and, probably, still

coal, and that was a pebble of water worn grey quartz, in Backworth Colliery, near Newcastle; we may be tolerably certain that such a circumstance is not common, as the high character of the Newcastle coal arises, in part, from the total absence of foreign matter.

Other arguments, to prove that the plants which formed coal were either not drifted at all, or at least not from any great distance, may be found not only in the perfect state of the leaves of many Ferns, but in the sharp angles of the stems of plants which there is every reason to believe must have been of a very succulent nature, such for example as *Favularia tessellata*, tt. 73, 74, and 75 of this work; and many of the *Sigillarias*, some of which occur with their surface marked with lines and streaks so delicate, that a day's drifting would have injured them. Again, at t. 76, we have figured a cluster of the fruits called *Cardiocarpum acutum*; had these been drifted, one would think they must have been dispersed, instead of being collected into one spot, just as if they had fallen there from the plant that bore them.

That the fossils which we find irregularly interspersed in the sandstones, or shales, of this formation, may have, in some instances, originated from drifted vegetables, there is, perhaps, reason to believe; thus it may have been with *Dicotyledonous* trees, fragments only of whose stems have been traced 70 feet long, without either extremity

being seen ; these we are sure must have grown upon a dry surface, and that surface have been unchanged for many years. And, in fact, they are found in just the state in which we should expect to find drifted stems, their limbs shattered, their bark beaten and rotted off, and their wood in a high state of decay. But that any considerable part of the plants which formed the beds of coal were drifted at all, appears, from the foregoing remarks, to be highly improbable ; that they should have been brought by equatorial currents from the regions of the tropics, is perfectly chimerical.

When such a mass of vegetable matter as is now periodically brought down by the Mississippi, is deposited upon mud, or sand, of which the bottom of some of its branches, or bays, may consist, and is there covered by another bed of sand, or mud ; is it likely, that, if, at any future period, the Carbonaceous deposit should be removed, the surface of the beds, either above or below it, would be even and flat ? Would it not rather be found, that the interstices and inequalities which there must be betwixt the trunks of the trees, had been filled up by the matter which covered the mass, and that some of the stronger stems, having settled unequally, had stood out, penetrating the surrounding soft strata, either above, or below ? Something of this kind, under similar circumstances, must, at all times, have been the case ; yet, nothing like an indication of it attends

our coal beds, for, not only are they, as before observed, free from the admixture of matter foreign to the formation, but the surfaces by which the coal is separated from the beds above and below it, are as even and well defined, as those of the limestones in the lower part of the series.

From the circumstances already related, we are compelled to the conclusion, that the beds of coal chiefly originated in vegetable matter which lived, died, and was decomposed, upon the spots where we now find it. The analogy of Peat, at the present day, naturally suggests itself; and, according to this view of the subject, we must consider each of our coal beds as having originated in an extended surface of marshy land, covered with a rank luxuriant vegetation. Should the length of time required for such an accumulation of vegetable matter suggest itself as a difficulty, it may be in part got over, when we bear in mind the fact of the enormous size of the individual plants, and that all those having any living analogues, sufficiently attest a much more rapid growth, consequent upon a heated humid atmosphere, than, at present, is anywhere known to take place. The difference is, probably, not greater betwixt the stunted growth of an Iceland vegetation of the present day, and the rank luxuriance of a tropical swamp, than between even the latter and the vegetation of the Carboniferous period.

The remains of *Stigmaria* are so abundant throughout the whole of the Carboniferous for-

mation, that it is impossible to travel far along any road, without its form being detected by the practised eye. In some of the best and most closely observed instances of its mode of occurrence in the bed before described, the arms could be traced from the central dome, slanting downwards into the coal, where all trace of them was completely lost. Coal, which rarely bears any outward vegetable form, presents that of *Stigmaria* oftener than any other, and it is certainly one of the most abundant fossils of the whole formation; from which facts, we should appear to be fully warranted in considering, that the growth of plants of this class was one of the great means made use of by the Almighty Architect of the globe, in absorbing and rendering solid that excess of Carbon, which, it is believed, must, at the period of the formation of the Coal-measures, have existed in the atmosphere; thus rendering it fit for the support of animal life, and, at last, a proper habitation for man. We cannot contemplate this storing up such a mass of combustible matter, and the iron which always accompanies it in the depths of the earth, at a remote epoch, for the consumption and enjoyment of creatures, afterwards to exist on its surface, without being struck with the benevolence and wisdom manifest in the design.

Whilst contemplating a bed of coal as the product of vegetation swept from a higher level of dry land, the question is ever recurring—where was the land?—a question which, as far as we

know it, is impossible to answer; and which might be considered alone sufficient to shake the theory of the Coal-plants having been drifted from neighbouring hills. We are well aware that this is but one of a thousand questions in Geology more easy to propound than to solve; but, surely, there ought to be some indication of those rocks, of anterior formation, on which this mass of vegetation grew; the surface that could supply so much, could be of no inconsiderable extent. That the plants had not been brought from a great distance, is proved, by the perfect state of preservation of the most delicate filmy leaves. The only rocks of the older formation, near to the great Northern Coal Field, are the Cumberland group, and the Cheviots; but it is certain that the former were protruded at a period long subsequent to the formation of the Coal measures; and, although there is in the case of the Cheviots a want of evidence to carry us so far up in the great series, yet we are sure that they rose, after the deposition and consolidation of the older members, at least, of the Carboniferous formation. The beds below the Coal measures, do now rise, at their western edge, to a height somewhat mountainous; but here, again, we have proof of a rising, long posterior to the formation of the coal; and they are, besides, a part of the series we are considering, and are characterized by the presence of the same class of vegetable fossils as have, doubtless, formed coal.

There are three principal varieties of Bituminous Coal, each of which occur in the Northern Coal Field;—viz. fine caking Coal, which is a crystalline compound, breaking into rhomboidal fragments; Cannel, called, also, Splint, and Parrot Coal, which is compact and tough, breaking with a conchoidal fracture; and Slate Coal, which is a mixture of the two other varieties, in thin horizontal layers.

The finest caking coal, of which the Newcastle Coal Field principally consists, being, as before stated, a crystalline compound, its constituents must have been in a state of solution. Cannel, or Parrot Coal, often bears the impression of plants, as does the third variety; but it is possible to prepare slices of all of them so thin as to be transparent, which, upon examination by the microscope, show the tissue of the original vegetables very clearly; Cannel Coal seems to retain it throughout the whole mass, whilst it exists in fine coal in small patches only, which appear, as it were, mechanically entangled.

By the microscopic examination of coal, a singular arrangement becomes visible; a number of elongated tubular passages are found, filled with a beautiful wine-yellow coloured resinous matter, which is the most volatile part of the solid coal, being what is first driven off when coal is exposed to heat. Each variety of coal exhibits this structure in a greater or less degree, but fine coal the least, as, in it, the vegetable elements appear to

form an almost perfect union. When the different varieties of coal occur together in the same seam, or bed, as they frequently do, they are not indiscriminately mixed, but have a well defined line of separation between them. In Wylam Colliery, near Newcastle, the principal bed of coal is, at its lower part, a fine splint, approaching Cannel, the middle and main part is Crystalline coal, and the upper part of the seam is a mixture of the other two, in alternate layers, thus presenting, in one seam, all the three varieties of the Newcastle district. But it is not the seams of coal only which exhibit these abrupt changes of nature, as small specimens may be gathered at the mouth of every mine, which, within the compass of an inch, will, upon their perpendicular faces, show alternate layers of fine crystalline coal, and coal destitute of crystalline structure. It is certain each bed of coal, and more particularly each separate layer in that bed, must have been placed in precisely similar circumstances since the deposition of the vegetable matter of which it is composed ; and we cannot suppose that matter to have obtained any of its elements after it was buried in the earth, but rather that the difference between the several varieties of coal and recent vegetables, as shewn by analysis, must have arisen from the play of affinities which has taken place in the mass when reduced to such a state as to allow of motion amongst the particles, (the result of the most complete solution of the fibre being

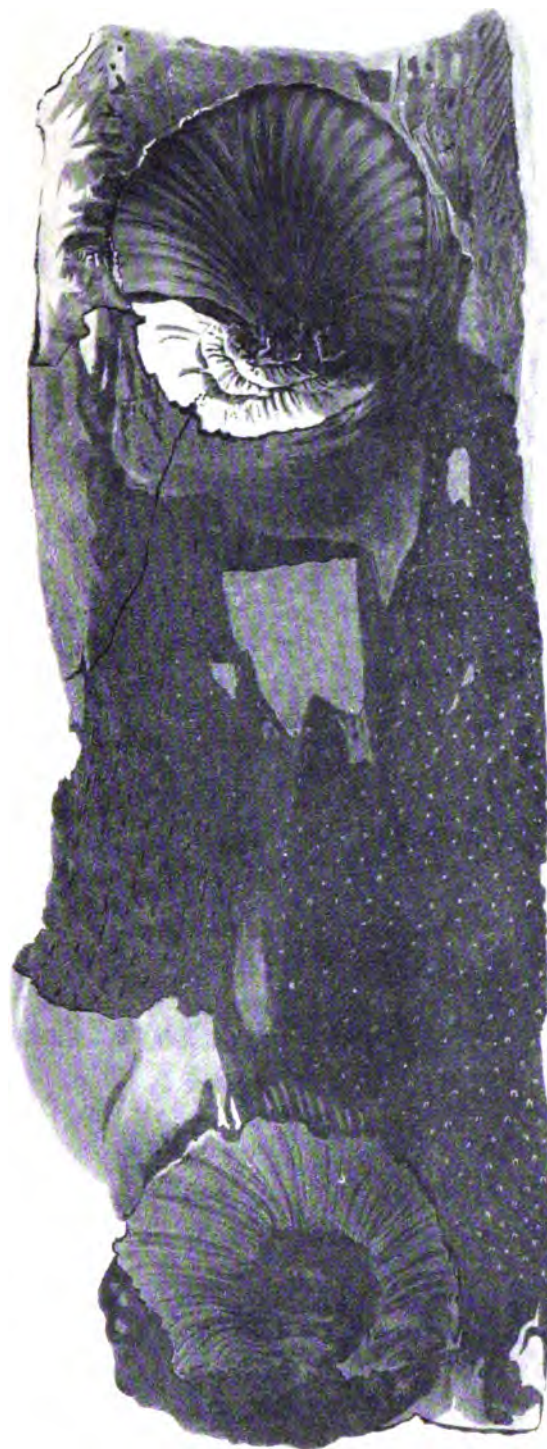
the finest coal, whilst in the indifferent varieties this motion appears to have been obstructed by the tissue,) from which it seems naturally to follow that the several varieties of coal arise from some difference existing, previous to deposition, and that difference is most likely to have been, originally, in the nature of the plants, of whose remains the coal beds consist. If we are right in this conclusion, we are thus furnished with an additional argument against the common opinion of the origin of coal; if the vegetables had been washed from a distance, is it likely that the different kinds would have separated so completely, as to have produced the several varieties of coal, so distinct from each other? often in layers, far too thick and continuous for us to suppose them to have originated, but from a multitude of plants of the same kind. However this may have been, we have little doubt of being able to pronounce, with tolerable accuracy, as the knowledge of the subject extends, what the plants were, the remains of which are of such incalculable value to us in the form of coal.

It was at one time believed, that the remains of Dicotyledonous woods did not exist in the Carboniferous formation; but subsequent observation, aided by the power of the microscope, which has been applied with so much perseverance and effect, by our esteemed friend and fellow labourer, Mr. Witham, has enabled us to detect them in almost every quarry. Nevertheless, the great bulk of the vegetables, of what may emphatically

be called the Carboniferous period, undoubtedly have been of the genera *Sigillaria*, *Lepidodendron*, *Calamites*, *Stigmaria*, and *Ferns*. The more woody plants, on the contrary, after being buried, were able to resist decay, until their fine tissue was completely filled up and sustained, by the gradual infiltration of mineral matter.

It is in consequence of the almost universal change into coal, which has taken place in plants of this period, that their internal organization is so obscure; but, fortunately for our science, individuals are sometimes found uncompressed, and retaining the form of their internal organization in considerable perfection.

Mr. Witham has thus, already, been able to detect the structure of a *Lepidodendron*, which was fortunately found by the Rev. C. G. V. Harcourt, and upon which we shall have to make some observations in the present volume. To this part of the subject we should wish to direct the attention of our friends, more particularly such as may be resident in those Carboniferous districts where *Calcareous Spar*, and *Sulphuret* and *Carbonate of Iron*, abound; it is only where mineralizing matter has been held in chemical solution in abundance, that we can expect to find the delicate and evanescent textures of the coal fossils preserved. By careful examination in such situations, and the aid of the microscope, the secret of their real nature will be revealed.



1/2 Natural Size.

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BOTHRODENDRON PUNCTATUM.

(Corticated.)

From the roof of the High Main Coal-seam, at Jarrow Colliery.

This is the remains of some large plant, of which the scarred stems and the bodies that belong to the scars alone are left.

Upon the surface of the stem are discoverable a considerable number of minute dots, arranged in a quincuncial manner, something less than half an inch apart: and it is probable that those may be the scars of leaves; but at present there is nothing to prove that they were so.

At intervals of ten or eleven inches, the stem is marked with deep circular concavities, four or five inches across, at the bottom of each of which is a distinct fracture, indicating that something has been broken out; while the sides of the concavities have concentric marks, as if from the pressure upon them of rounded scales.



ARAUCARIA PEREGRINA.

Communicated with the following fossil, from the Blue Lias of Lyme, in Dorsetshire, by the Misses Philpot.

The specimen, which has been carefully cleaned from the lias when soft, is one of the most perfect that we have ever seen; every thing, even the surface of the leaves, having been completely preserved. Unfortunately, the accompanying figure is not so good as could be wished; but we trust that any defects in it will be supplied by the following description of the specimen.

It consists of a branch upwards of a foot long, from the sides of which proceed four or five laterals, spreading widely from the main stem, and slightly curved. Both these, and the principal stem, are closely covered by thick, ovate blunt leaves, which seem to have had a very broad edge, and a rhomboidal figure, and which

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Natural Size.

STROBILITES ELONGATA.

From the Blue Lias of Lyme, in Dorsetshire ; communicated from the Museum of the Misses Philpot.

This remarkable fossil has occurred in a rounded mass of Lias, the fracture of which has discovered it. It was evidently a cone formed of broad imbricated scales, which were longer about the middle of the cone than either at the base or apex. The scales in front of the specimen having been imbedded in the lias, are broken off, and nothing remains of them but their fractured bases ; but from the impressions of those at the side, it would seem that they had rather a lax arrangement, and were broadest at the point of attachment to the axis, that they tapered to the points, which were a little recurved, and that these points were abruptly truncated. This structure is sufficiently visible in some parts of the accompanying figure ; but it is much more perceptible in the fragment that corresponds with the part now represented ; from this fragment we are able to discover that the lower scales were not only shorter,

but also thinner than the upper. No trace of the original surface remains; but in its room, a thin stratum of cracked and broken carbonaceous matter overlies all the parts.

We presume there can be little doubt of this being a cone of some kind; and if so, it must have belonged either to some Coniferous genus, or to one of the Cycadeæ; for no other natural orders bear cones of such a kind.

To which of these it is to be referred, can scarcely be a matter of doubt. The great breadth of the scales at the point of their insertion into the axis is at variance with the structure of *Zamia*, to which alone, among Cycadeæ, the fossil can be compared; but it is in perfect accordance with that of Coniferæ, whether we contrast the specimen with the narrow cones of *Pinus Strobis*, and its allies, or with the broad ovate ones of such plants as *Araucaria* and *Cunninghamia*. It is, however, far from agreeing with any modern species, from all which its tapering but truncated scales distinguish it essentially.

Is it possible that it can be the fruit of the plant last figured? This must of course be mere conjecture, there being no sort of evidence either for or against the supposition. It is nevertheless deserving notice, that supposing that plant to have been related to *Araucaria*, this fruit is of the same nature as it would in that case have been likely to have borne.

CYCLOPTERIS OBLIQUA.

Cyclopteris obliqua. *Ad. Brongn. Prodr. p. 52. Hist. des Végétaux Fossiles. 1. 220. t. 61. f. 3.*

Cyclopteris auriculata. *Id. Prodr. p. 168.*

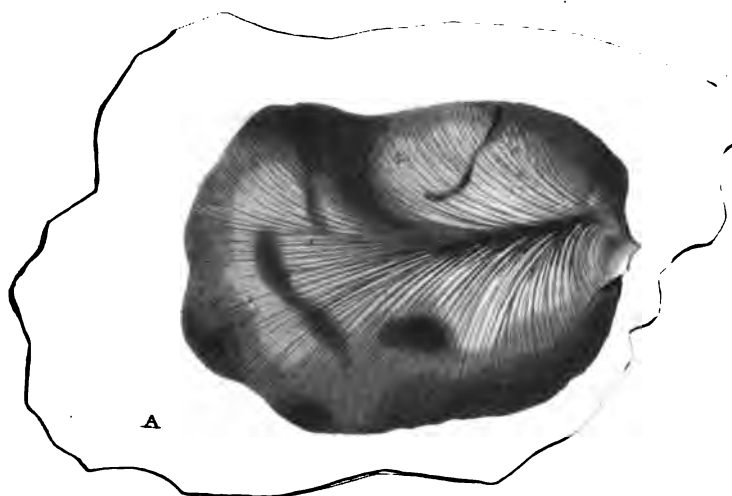
Specimens of this extremely well marked fossil are not of very uncommon occurrence, but they do not seem to have been met with out of England. M. Adolphe Brongniart figured it from Yorkshire specimens, given him by Mr. Greenough; those now represented are from Jarrow Colliery; and we have received a drawing of a small specimen from Mr. Conway, found in the mines of Pontnewydd, near Newport, in Monmouthshire.

It appears to have varied a good deal in size, our fig. A being of the natural dimensions, B about a quarter less than the natural size, and Mr. Conway's much smaller than even A.

There is no living plant with which this can be identified, nor any fossil species for which it can be mistaken, the singular manner in which the base is hollowed out giving it almost the appearance of a human ear. It is not certain whether it was a simple leaf, or only a division of a compound leaf; but the want of any stalk to the base, in room of which there is the trace of what appears to have been a distinct disarticulation, inclines us to the belief that the latter is the more probable; and if so, it must have been, when alive, one of the most remarkable of its tribe, far exceeding in its dimensions any recent species.

The veins all radiate and dichotomize from the very base, and in no case appear to run together into a midrib; thus answering to the structure on which the genus *Cyclopteris* essentially depends, provided the leaves were simple. But if they were compound, it would rather belong to the genus *Neuropteris*. See tab. 91 A.





NEUROPTERIS INGENS.

We have received this species from several different localities. The specimen figured is from Jarrow Colliery, and we have several others in nodules of carbonate of iron from the Yorkshire Coal field. They vary in size from two inches and a quarter to nearly three inches in length, by from an inch and three quarters to two inches and a quarter in width.

Their texture seems to have been membranous, if we can judge from the very filmy and delicate state of their impressions. The outline was rather wavy, and the apex rounded; the base was apparently heart-shaped, and more or less oblique. The veins are almost those of *Cyclopteris*; that is to say, they radiate from one common point, with little or no tendency to run into a midrib; but in some species they decidedly do coalesce; and the great resemblance the leaflets bear to those of

Neuropteris auriculata, leaves scarcely any room to doubt their having belonged to a similar plant.

In fact, it is not easy to say in what respect *N. ingens* differs from the species just mentioned ; but we are nevertheless persuaded that they must have been specifically distinct, for the leaflets of the present plant are at least twice, and frequently nearly three times as large as the largest of those of *N. auriculata*.

Is it not possible that *Cyclopteris obliqua* and *Neuropteris ingens* may both be leaflets of the same plant, the former coming from the base, and the latter from the sides of the divisions of the leaves ? like the roundish, auriculated, and oblong leaflets of *Neuropteris auriculata*.

CYCLOPTERIS DILATATA.

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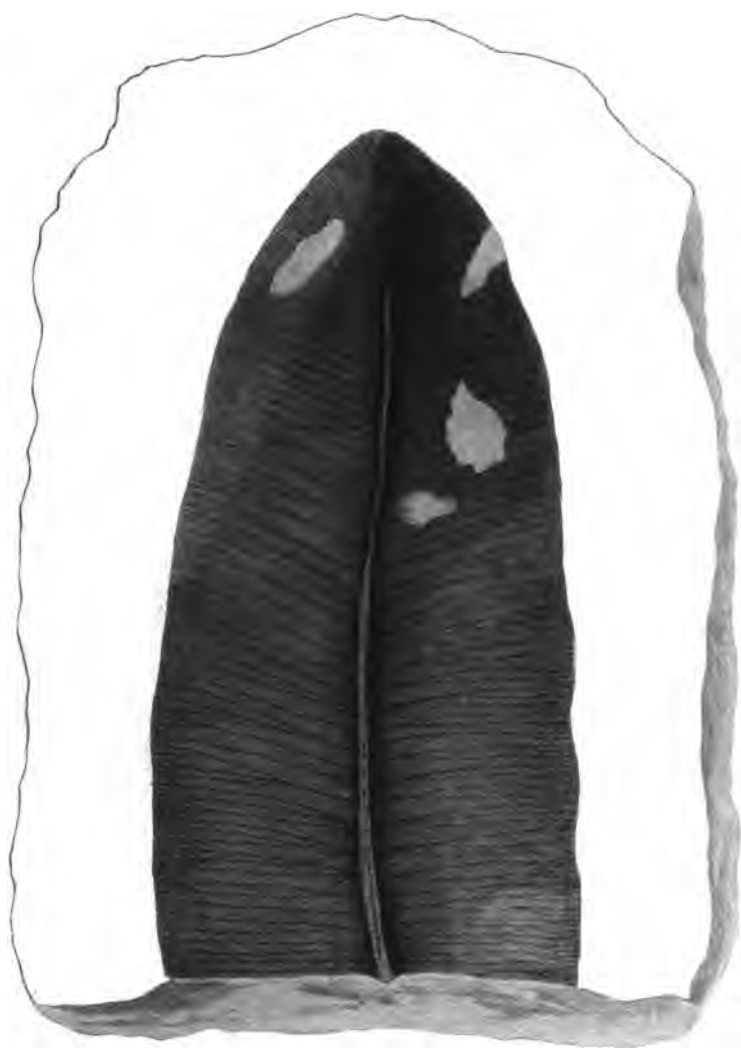
From Felling Colliery.

This appears to have been of a very thin and delicate texture, and of considerable size; we possess one specimen, containing two-thirds of a leaf, which measures eight inches in breadth; it is probably on this account that it is never found perfect.

The outline of this species varies from nearly orbicular to oblong, with the principal diameter parallel with the base; it has an undulated surface, and its base is closed by two deep and equal lobes, which overlap each other. The veins radiate and dichotomize from their common point, without the slightest tendency to form a midrib.

At first sight it might be taken for *C. reniformis*; but that species does not seem to have been of so delicate a texture, was not much more than one-

third the size, and had not its base closed up by two overlapping lobes ; on the contrary, its lobes were so short, as not to meet by a considerable distance.



Natural Size.



Magnified.

Robinson del.

Published by Ridgway & Sons, London, Oct. 1833.

TÆNIOPTERIS MAJOR.

Found in the shale of the Gristhorpe bed, in the Oolitic formation, near Scarborough, by Mr. William Williamson, Jun., to whom we are obliged for an excellent drawing, and for the following note.

“The specimen is about five inches long, and two broad; the midrib is strong, and has a line upon its centre which gives it the appearance of having being once angular.” (This line is no doubt the furrow that always exists upon the petioles of leaves, and thus shews the impression to be that of the upper surface.) “Running out perpendicularly from this midrib are numerous veins, which are twice or thrice forked, first near the middle, and again near the margin, in which character it differs from *T. vittata*. Some of the veins are even four times branched. The lower extremity of the leaf is destroyed.”

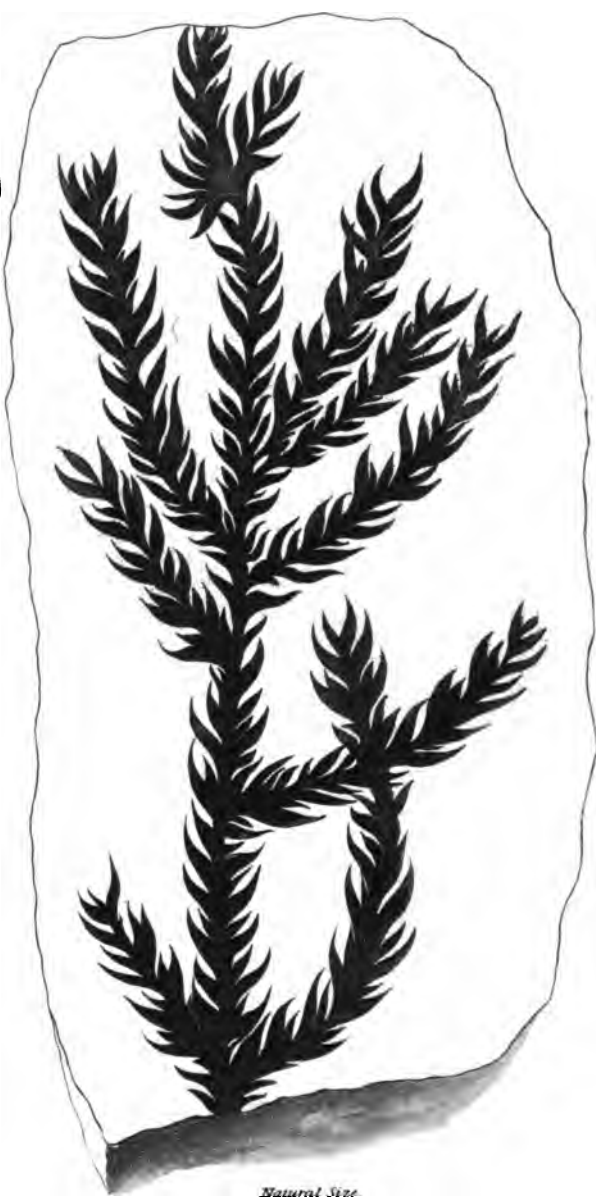
To this we would only add, that while *Teniopteris vittata* is hardly distinguishable in its fossil state from the Indian *Aspidium Wallichianum*, the species now represented may be almost identified with our British Harts-tongue Fern, *Scolopendrium officinarum*, which may be found in every old well, unless indeed the base of the fossil should prove, when discovered, to be much more different than its apex is.

As it would be a highly interesting discovery if the identity of the fossil and recent species could be established, we especially recommend a search after more complete specimens of this plant to our indefatigable friends at Scarborough.

Fig. 2



Fig. 7



Magnified

Natural Size

The appearance of this species calls to mind several kinds of *Asplenium*, but we have not discovered any one with which it is of importance to compare it.

remains of a mere root, then it will be impossible to refer it to any class, order, genus, or species, and, consequently, its recognition will be useless in the identification of strata; for it, or what will not be distinguishable from it, may be expected in any geological formation of whatever age.

We have, however, thought it as well to admit a figure of the impression, firstly, for the sake of explaining what we conceive to be its real nature; and, secondly, because it seems to throw some light upon the circumstances under which the coal measures were formed.

If this fossil were the impression of the stem and leaves of any plant, there are two points of structure which would certainly be discoverable in a perfect specimen. In the first place, the leaves would be of nearly one size and figure throughout the branch; and, secondly, they would be inserted upon the stem with great symmetry and regularity. As no instance of any departure from this rule can be adduced among recent plants, to whatever part of the vegetable kingdom they may belong, we are justified in considering it, also, absolute in what regards extinct races; and, for physiological reasons, which all botanists understand, the same law is of necessity true of branches; they also ramify upon a uniform symmetrical plan from which there can be no real departure. The subdivisions of this fossil are, on the contrary, irregular in the highest degree; no two can be

found precisely alike; they are of many different sizes; and they spring from the surface of the central part in a most confused and crowded manner; nothing even approaching to symmetry, either of form or subdivision, can be detected among them. The fossil, therefore, consists neither of branches nor leaves.

It is among roots, and especially those of water plants that its analogue is to be sought. Irregularity and want of symmetry are the constant characteristics of roots; and that not only when they have to insinuate themselves among earth, but, also, when they develop in water, or the still more unresisting medium of air. Let, for example, the roots of a melon, growing in water, or of any tree or herb, whose roots have accidentally found their way into a tank, or wet ditch, be compared with this, and their identity will be too striking to be overlooked even by the most careless observer. We, therefore, give the fossil no name; but merely leave its representation as an explanation of its real nature, for the information of those who had not previously considered the matter.

If, however, its name must be erased from the species of the Fossil Flora, it is not the less interesting in another point of view. Its presence may be considered one of the strong arguments derived from the consideration of organic remains, in favour of the theory that the plants which formed coal were either deposited where they grew, or at

least were not floated from any considerable distance. It is well known that however capable the stems of plants may be of resisting the action of water, young roots, and especially those of aquatic plants, are so brittle, that but little violence is required to break them in pieces; and if they are exposed for any considerable time to the action of a body of agitated water, they would be totally destroyed. This, on the contrary, is so nearly perfect, that we may reasonably conclude that it had suffered but little disturbance before it was imbedded in the shale in which its remains have now, after so many thousand ages, been discovered.

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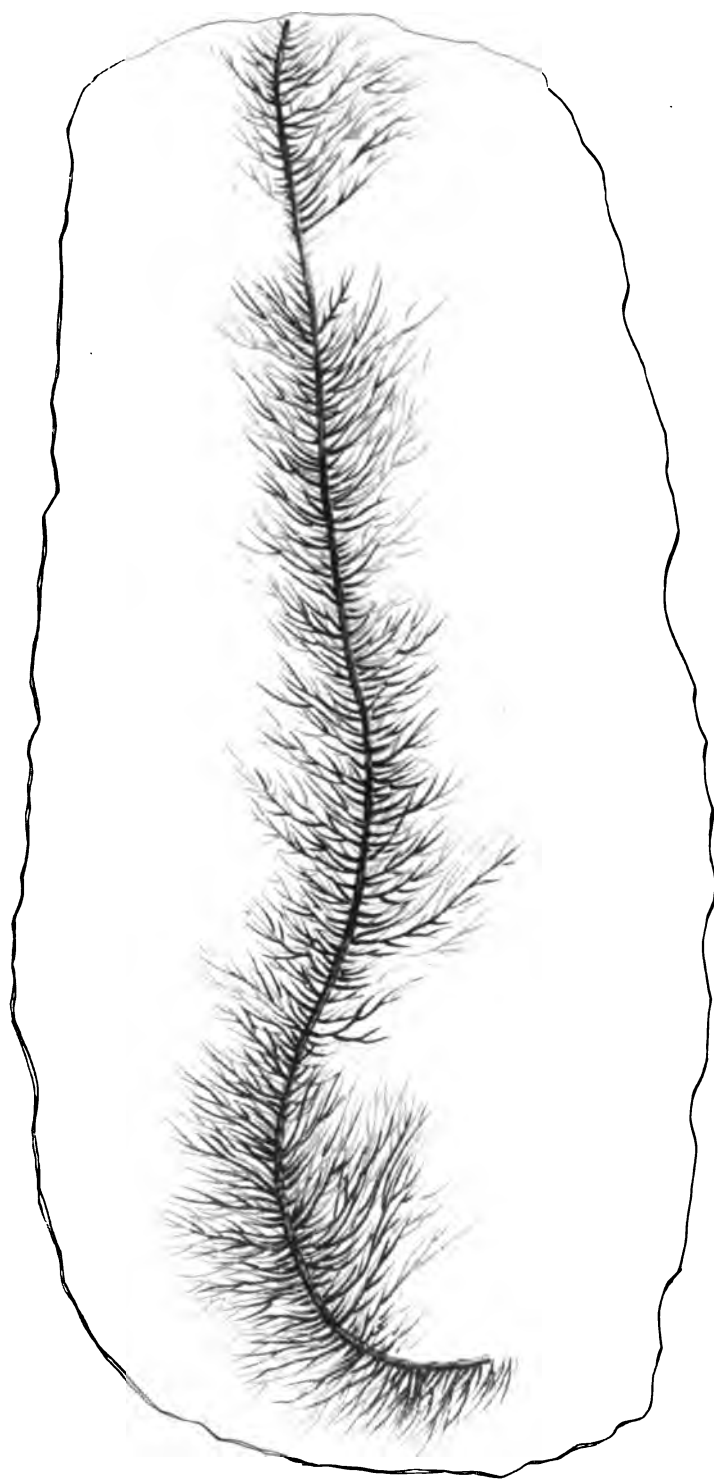
16. The sixteenth part of the document is a list of names and addresses of the members of the committee.

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Half Size.





PINNULARIA CAPILLACEA.

From the Leebotwood coal pit, whence specimens have been communicated by Professor Buckland.

It occurs in small fragments consisting of a linear central part or axis, from which at regular distances, on opposite sides, spring capillary appendages divided in a pinnated manner. The segments of these appendages, exhibit no trace whatever of leaves, nor in fact any appearance except that of very narrow dark lines, placed either in opposition or alternately. At the base of each opposite pair of appendages the central part is slightly tumid.

The kind of considerations that lead us to reject the last subject from the list of fossil species, induces us to add this to the number already described, for it will be found to possess all the characters which we have shewn to indicate stems and leaves. What we have called the central part we consider the stem, and the appendages leaves ;

leaves, however, which it may be supposed were submersed, if their thinness and want of apparent veins are taken into account.

Had this, instead of the last, been called *Myriophyllites*, nothing could have been objected to the name; for it is so like the submersed part of *Myriophyllum spicatum*, or rather of some of the Indian and South American species of the genus, even to the slight swelling of the stem at the insertion of the leaves, that we do not see how any botanist could prove them to be even different. Nevertheless, as we are quite sensible of the danger of speaking with confidence as to the certainty of such identifications, founded merely upon similarity in external appearance, and especially as the name *Myriophyllites* has already been applied to a totally different fossil, we prefer coining a new and unexceptionable generic title, which may include any similar remains that shall hereafter be discovered.

From an observation of Count Sternberg in figuring the aquatic leaves of *Myriophyllum*, it appears as if he expected that the fossil genus *Sphenophyllum* might produce such; it is more probable that *Annularia* and *Asterophyllites* consist of the aërial portions of plants whose submersed parts are referable to *Pinnularia*; but this is, in the present state of our knowledge, mere conjecture.

LEPIDODENDRON STERNBERGII.

Lepidodendron Sternbergii. *Supra*, vol. 1. t. 4.

The difficulty of determining the species of Lepidodendron, with anything like accuracy, seems wholly insurmountable, until we shall have more positive evidence as to the manner in which the scars of the leaves were changed in appearance by the age of a specimen. For this reason we shall figure whatever illustrative cases we may meet with, whether they belong to species already described in this work, or not.

Among the plates of Count Sternberg, is one that represents four states, of what he calls *Lepidodendron dichotomum*, of which one appears to M. Adolphe Brongniart, altogether different from the other three. The single figure is supposed to represent a species already published at tab. 5, of this work, under the name of *L. Sternbergii*; and

the other three are referred to a doubtful species, thought to be even a distinct genus, called *L. laricinum*; to this our *L. dilatatum*, tab. 7, fig. 2, approaches very nearly.

The plant now published, is, we presume, the *L. laricinum*. It differs from *L. Sternbergii*, only in the more truly rhomboidal figure of the scars of the young specimens; and, perhaps, in the greater size of the leaves. It shows the different states in which portions of the same species may be expected to occur; and, together with an interesting series of specimens which has been put into our hands by Mr. Prestwich, leads to the opinion that *L. Sternbergii*, and *L. laricinum*, are identical, as Count Sternberg considered them. Fig. *A*. and *C*. are from Hebburn Colliery, and are preserved in the Museum of Sir John Trevelyan, Bart., of Wallington; at *A*, the leaves are still adhering to the stem; in *C*, they have all fallen away, the scars are altered in appearance, and the dimensions are much augmented. Fig. *B*, is from Colebrook Dale, where it was collected by Mr. Prestwich; it shows, in a most satisfactory manner, the origin, size, and form of the leaves, which are, it can no longer be doubted, what we call *Lepidophylla*.

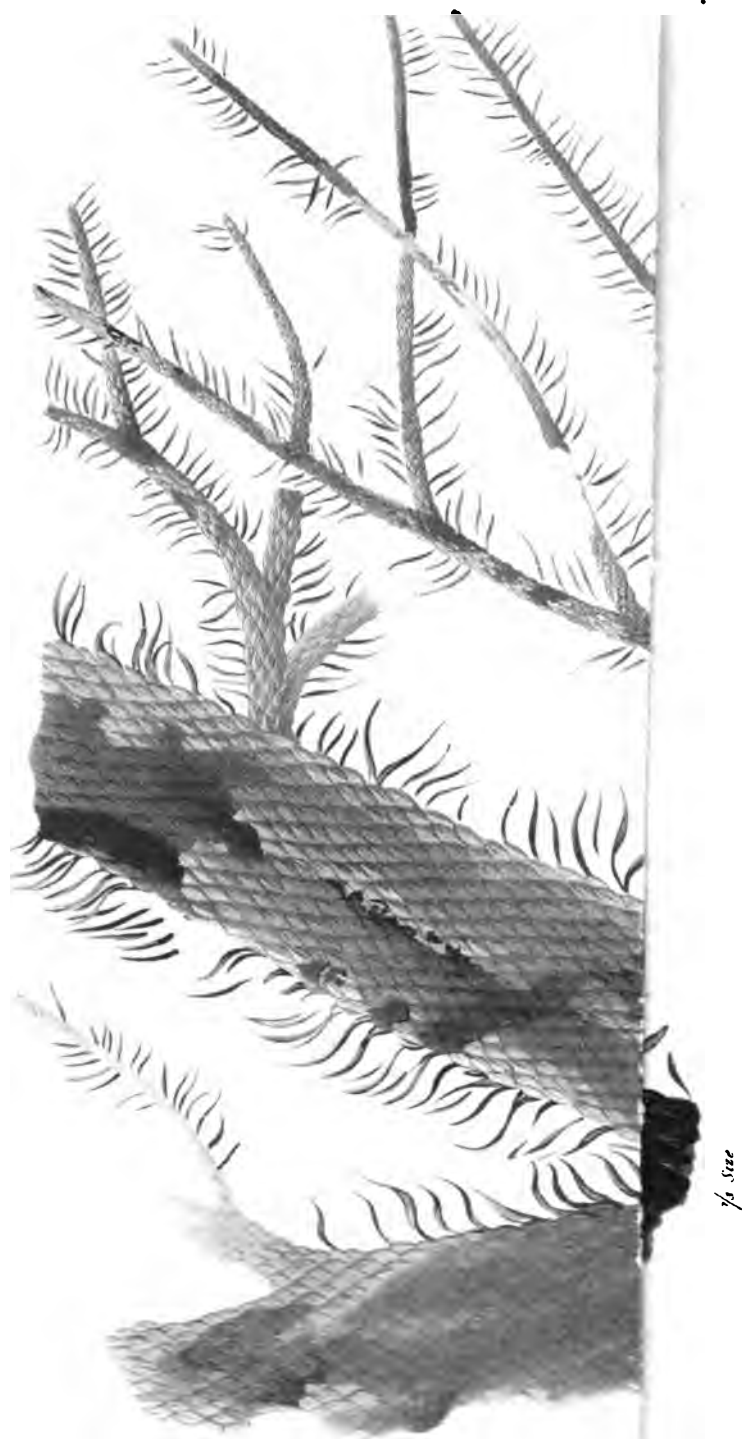
MEGAPHYTON DISTANS.

Megaphyton frondosum. *Artis Antediluv. phytol. t. 20.*

From the shale above the low main coal seam at Felling Colliery.

It was upon such remains as this that Mr. Artis formed the genus *Megaphyton*, describing it as having an arborescent, simple stem, furrowed longitudinally, with a coarsely fibrous surface. His specimen was larger, and, in some respects, more perfect than this, but the form of the scars of the leaves was less distinctly defined. It is also certain, that the stem is not furrowed, but, like the last, has simply two rows of scars on opposite sides of the stem.

The near relation of this species to the last,



LEPIDODENDRON ELEGANS.

-
- Lepidodendron lycopodioides. *Sternb. Vers. fasc. p. 2, 31, t. 16, f. 1, 2, 4.*
 Lycopodiolites elegans. *Ib. Tent. Fl. primord. p. viii.*
 Lepidodendron elegans. *Ad. Brong. Prodr. p. 85.*
-

From Felling Colliery.

Our beautiful specimens of this species consist of remarkably well preserved casts of a large stem and several branches still attached to it. The scars had the acute and regular rhomboidal form of those of *L. Sternbergii*, to which this seems to be nearly allied. It differs in its leaves being much smaller and more delicate, and in the plant having had more slender and graceful shoots. In both species the leaves curve away from the stem, by which circumstance they are essentially distinguished from *L. selaginoides*, whose leaves are closely pressed to the stem.

We are unable to point out any satisfactory marks by which the old stems of *L. Sternbergii* and *elegans* can be distinguished, unless it be the greater breadth of the scars of the former species; a character which we fear will be found too indefinite to be applied with much certainty.

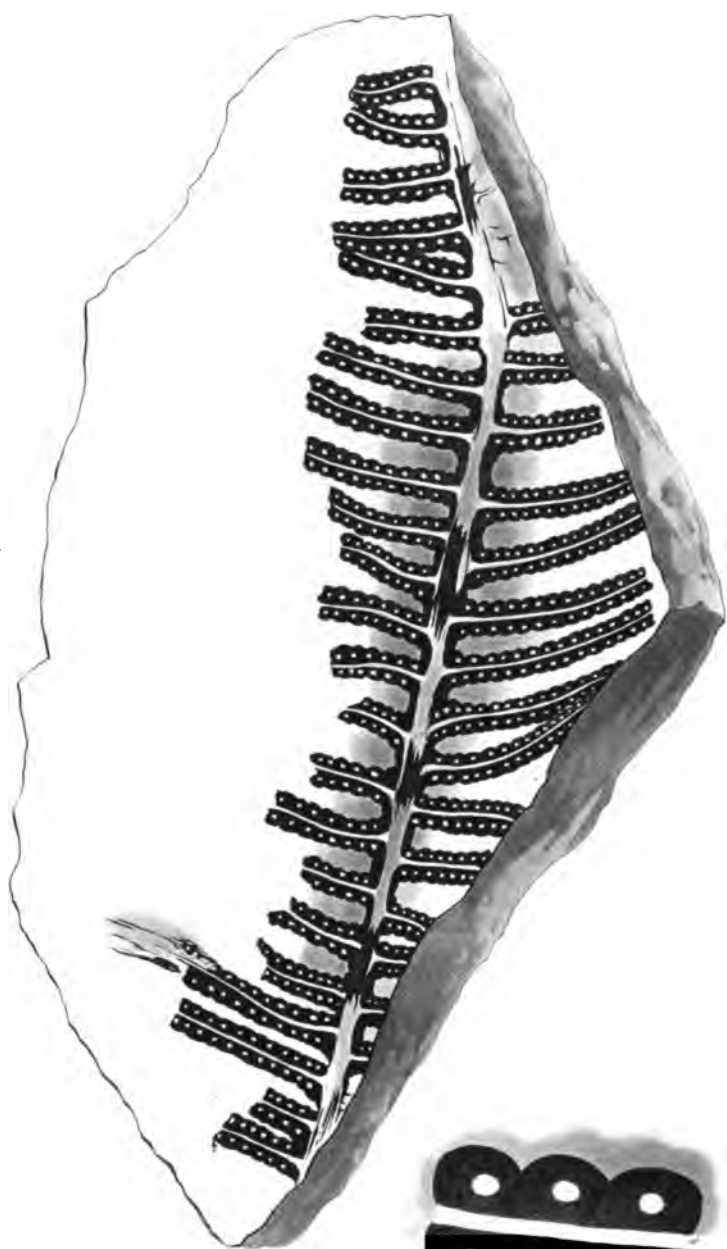
So much has now been said of the genus *Lepidodendron* in this work, and so very imperfect an idea is, we suspect, entertained of the appearance of those recent coniferous plants to which it is compared, that we shall endeavour to complete the illustration of the genus, as far as it is in our power, by devoting our next plate to the representation of some of those existing species which have the greatest apparent relation to it, and which are unknown in Europe, except in the Herbaria of Botanists. It will be seen how imperfect the ideas of those must be, who have no other notion of coniferous plants than what can be drawn from the pines and firs of European woods and gardens.

PECOPTERIS PROPINQUA.

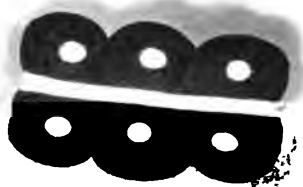
For the drawing and account of this, of which we have seen no specimen, we are indebted to our indefatigable correspondent, Mr. William Williamson, Jun. He says,

“At first sight, this plant appears to be the same as the *Pecopteris Polypodioides*, figured in a former number, but on closer examination, the outer edges of the segments are found to be undulated; in the centre of each undulation being placed the sorus, or mass of fructification. From the middle of the segments, veins or nerves strike out, in rather an oblique direction, which are bifurcated; one point extending to the sorus, and the other in an opposite direction; both being again bifurcated before they reach the outer margin. Although they vary considerably, I have found this difference in the arrangement of the veins to be a strong distinction between the smooth and undulated edged species; especially by an exami-

nation of the specimens in the choice collection of Dr. Murray, which is always open for the benefit of science. Sometimes one point appears to pass in a single line through the sorus, and the other is twice, or thrice branched, but some part of the nerve *always* extending to the sorus. There is so little of the stem remaining, that I have been unable to discover any peculiar characters ; but in the segments, the black carbonaceous matter is well preserved. When a fragment of shale containing one of these plants is split, the black substance forming the sori and midribs, adheres to the opposite side to the one bearing the impression, which occasions the white spots. This specimen was found by my father in Gristhorpe Bay."



Natural Size



Magnified

W. Williamson, del.

A



Natural size

B



Horizontal view

C



Magnified

PECOPTERIS UNDANS.

Of this we have seen no specimens. Mr. Williamson, Jun. has communicated the following memorandum with the drawing we now publish.

“This is one of the most curious plants I have seen found in this neighbourhood. The stem runs in a zigzag manner, and has a line down each side like a Neuropteris. The segments are about two-thirds of an inch long, and rather more than one-eighth in breadth, having a strong midrib which disappears at the apex. In endeavouring to trace the veins, I accidentally destroyed a portion of the black carbonaceous matter; which brought a very singular character to light; *a.* represents the plant as it lay in the stone, shewing the *upper* surface which was curiously undulated; when this part was removed, it left traces of the *under* surface upon the matrix, with two rows of minute sori in the hollow of each undulation, running from the midrib to the sinus of

the segments, as represented at *fig. c.* This will be the more intelligible if you consider *b.* to be an imaginary view of a horizontal section parallel with the midrib, cutting through three of the undulations, and shewing the position of the sori in the hollows."

Not having seen this plant we are ignorant whether its veins follow the lines of sori, or are otherwise arranged ; we therefore place the plant in *Pecopteris* with which it agrees in habit.

It is from the rich bed of Oolitic plants in Gristhorpe Bay.

SOLENITES MURRAYANA.

Flabellaria? viminea. *Phillips Yorks. Vol. i. p. 154, Pl. x. f. 12.*

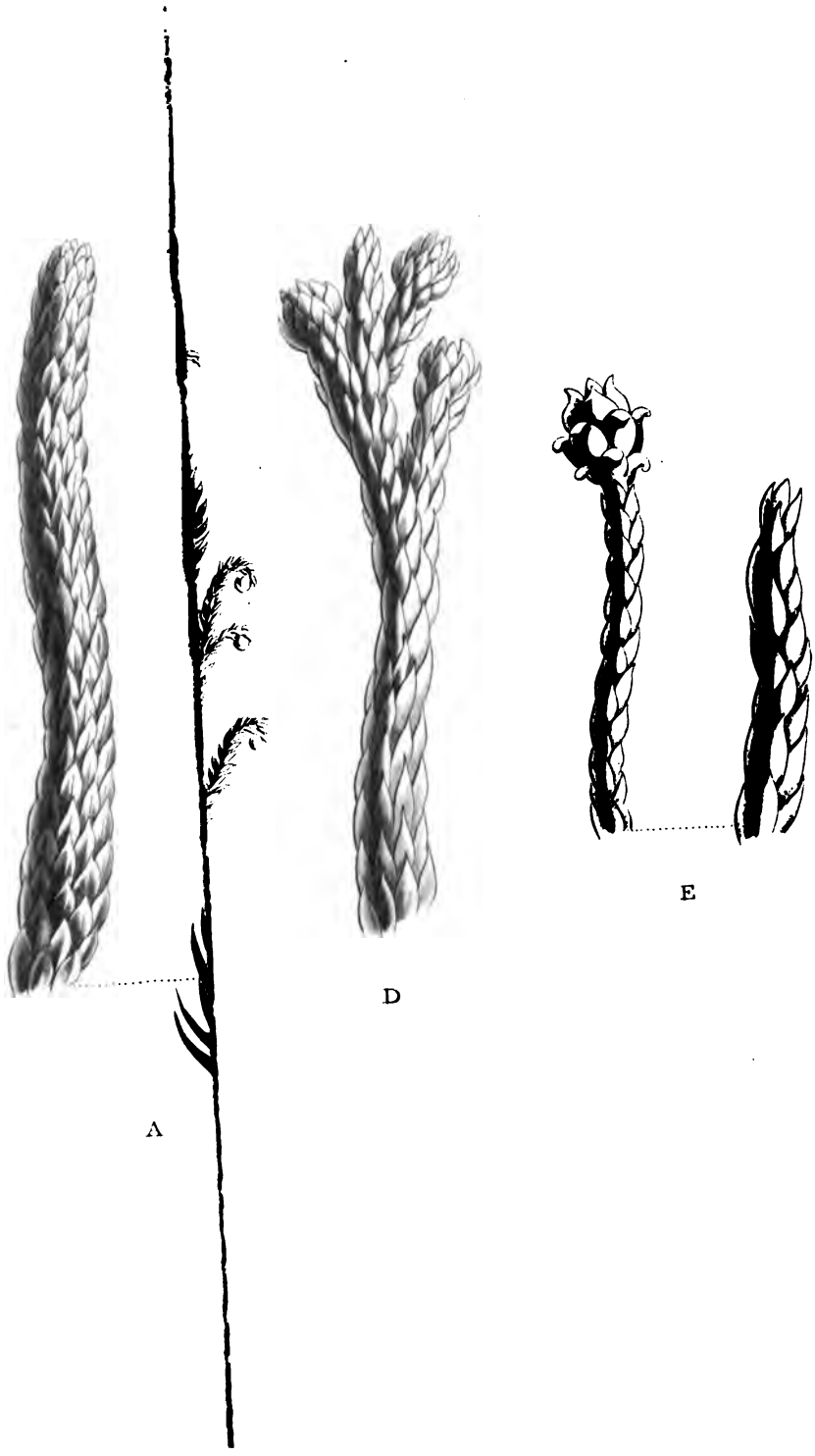
We have been favoured by Dr. Murray, with the following note upon this fossil.

“The plant now sent is from the rich deposit of Gristhorpe Bay, near Scarborough, occurring in the shale of the upper sandstone, belonging to the Oolitic formation; and is so slightly mineralized as to retain *flexibility*, and even in a certain degree *combustibility*. The plant appears to me, most analogous to a Fern, and to the genus *Isoetes*, to which it is allied by its habit, by the closely matted state of the leaves, by the half flattened structure of those leaves, and by the absence of every trace of leaf-sheaths, or fistular and jointed stems which might have referred it to Gramineæ. Still it can hardly be our *Isoetes lacustris*.

“By the bye, I have detected in several of our fossil Oolitic vegetables as slightly mineralised as

by about half their own diameter; in a barren state they have a slender wavy distinct midrib, from which proceed many very oblique veins, which are once or twice dichotomous; in a fertile state, no veins are to be discovered, but the whole of the under surface is covered by a multitude of small projecting circular spots, which it is to be supposed were the sori, or clusters of fructification.

From the complete manner in which the under side of the leaf is covered with fructification, it may be presumed that the elevated circular spots were *thecæ*, and not *indusia* of the nature of those in *Aspidium*; for in recent Ferns it is only the genera with naked thecæ, such as *Acrostichum* in particular, in which the veins and midrib are completely concealed by the fructification; in plants like *Aspidium*, the midrib at least is distinct, however much the veins may be hidden. We therefore conjecture that this *Pecopteris Williamsonis* belonged to the genus *Acrostichum*, to which the disposition of the veins offers no objection.



leaflet with a dense layer of veins. No structure is visible beyond this.

At first sight it resembles a Fern so closely, that one would scarcely doubt its being one; but upon a closer examination a circumstance will be detected which will throw some doubt upon the subject. All recent Ferns, with a pinnated structure have, as far as we have observed, either a distinct midrib to each leaflet, or, at least, such an arrangement of the veins, as gives the appearance of a midrib; and we believe it is, in fact, only in *Adiantums* and the *Hymenophyllous* section of recent Ferns, that a midrib is absent, whether the leaf is pinnated or not. But here the arrangement of the veins is such, that not the faintest trace of any thing like a midrib is discernible.

Even in fossil Ferns, or what are so called, it is only in the genus *Odontopteris* that such veins as those of the fossil before us are characteristic; but in that genus the leaves are bipinnated, and the leaflets grow to the stalk by their whole base, while in this they adhere by only a portion of their base, the anterior half being free and auricled.

Our fossil then is not only doubtful as to its genus, but even as to its affinity, for its veins are not exactly those of Ferns, and its external form is not exactly that of *Odontopteris*.

We find, however, a new red sandstone plant, placed by Adolphe Brongniart in *Neuropteris*, under the name of *N. Dufresnoii*, with which this accords

in its veins and mode of division; but as we cannot consider this species a true *Neuropteris*, for the reasons we have assigned, and as we are now acquainted with at least three distinct plants, which agree in the peculiarities just adverted to, we propose to form them into a new genus, to be called *Otopteris*, in allusion to the auricle (*ov̄s*) with which the leaflets are always furnished.—*See Tab.* 132.

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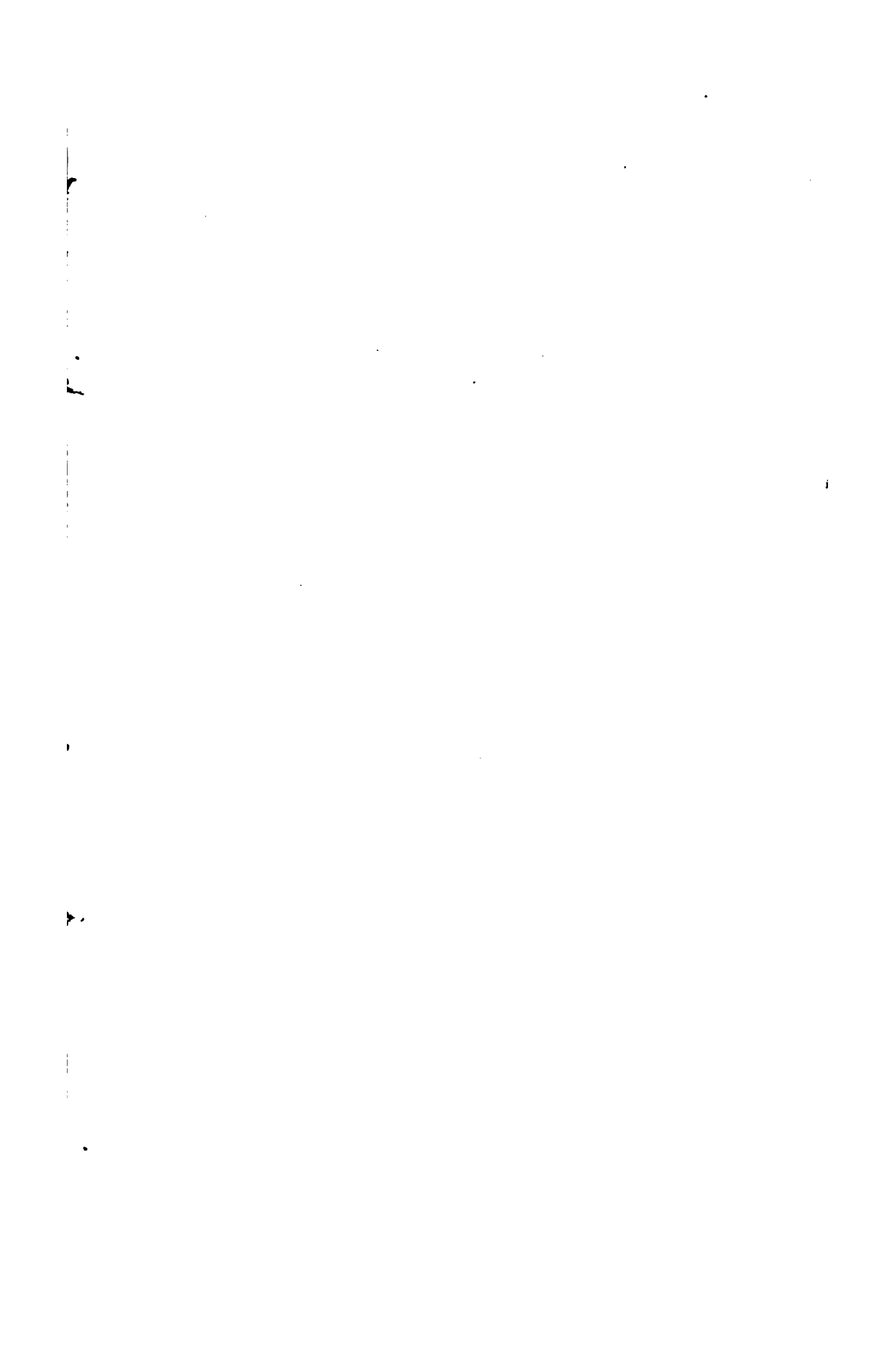


Fig 1



Fig 2



Natural Size

Fig 1.

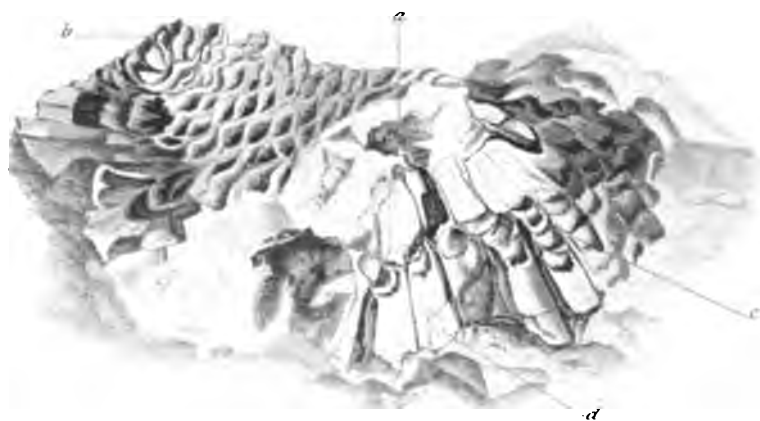
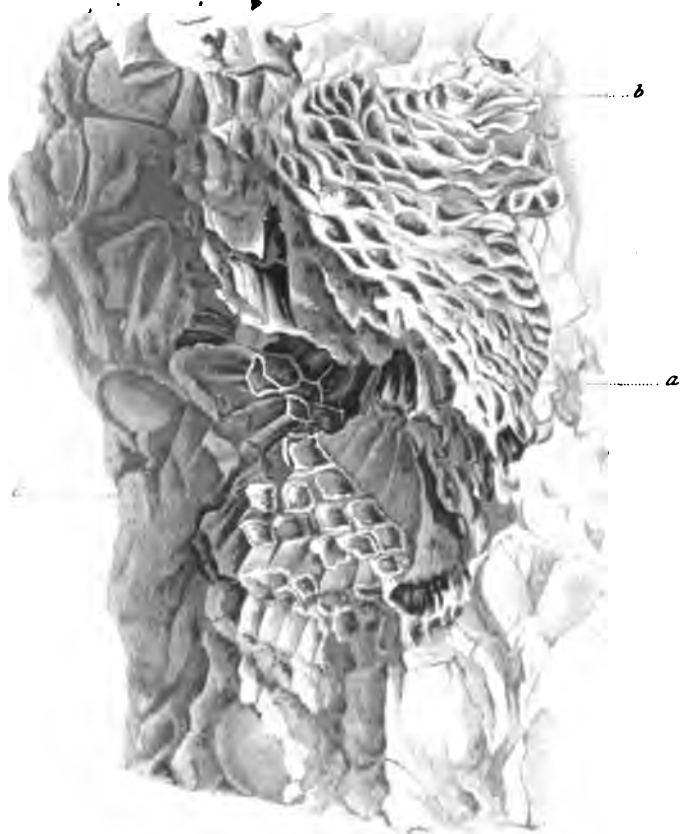


Fig 2.

Sowerby, del

Pub. by Messrs. Rudeman, London, Oct. 1834

STROBILITES BUCKLANDII.

From specimens belonging to Miss Bennett, the accompanying drawings were prepared for Dr. Buckland, to whom we are indebted for permission to publish them in this work.

They appear to have been cones, having a slender axis (*a. & b. figs. 1 & 2*), the whole face of which was covered with processes, which at the only remaining surface of the cone have now the appearance of scales. The axis is entirely gone, and the specimens themselves are crushed and broken, as if they had remained in water till they were rotten, and had then been suddenly exposed to some violent action, which broke them in pieces.

On the present surface of the fossil nothing can be traced except the scaly appearance; but it is to be observed, that on both specimens the supposed

scales curve *back* from the only end of the cone which is visible; on which account we conjecture that end to have been the base, for if it had been the apex the scales would rather have converged. At first sight it would seem as if these scales represented the true surface of the cone; but when we consider the extremely small space which intervenes between the axis (*a.*) and the surface, on the denuded side, and the length of the organs which evidently grow on the opposite side, we find ourselves unable to account for the total disappearance of corresponding organs on the denuded side, except upon the supposition that upon that side the principal part of the cone has been broken away. It would, therefore, appear as if the scales which now remain upon the denuded side, are the bases of bodies, the upper ends of which are left at *c* and *d*.

In the fractured parts, about half way between the axis and the surface of the cone, a number of lozenge-shaped cups (*c. c.*) are visible, with their concavities turned towards the axis; their margins have a broken appearance, and were apparently continuous with the part which actually grew to the axis. It is to be presumed the cups are the remains of the apex of the cell of a pericarpium.

The parts next the surface of the cone, forming the upper end of the supposed pericarpium, are four-cornered and wedge-shaped, but their points are so buried in the matrix of the fossil that they cannot be made out. At places (*d. No. 2.*) thin

plates seem interposed between these wedge-shaped bodies, but we find no evidence to show whether such plates are organic, or mere interpositions of earthy matter.

From the present state of the cones one might imagine that they were originally of an oblong figure; but if our conjecture, that the apparent surface is not the real surface, be well founded, they must have been nearly spherical.

Such is all that we can collect from the remains before us; scanty as the information is, it seems to shew that the fossil was of a spheroidal figure, and consisted of an axis upon which was planted a number of wedge-shaped, four-cornered, one-celled pericarpia, the upper end of which was solid, and the lower gradually thinned away into a base, which, when the cell was broken off, resembled a scale. Whether real scales were interposed between the pericarpia is uncertain.

It does not appear to us that such information is sufficient to enable a Botanist to determine the affinity of this fossil satisfactorily. That it was not a Fir cone, is rendered probable by the ready separation of the thick four-cornered apex of the pericarpia from the cell, analogous to which we know nothing in *Coniferæ*. For even in *Araucaria*, in which the seed is very large, and terminated by a broad scale, to the base of which it adheres (*See Foss. Fl. t. 87*), there is no such thickening of the upper end as we find in the pericarpium of the fossil; in fact

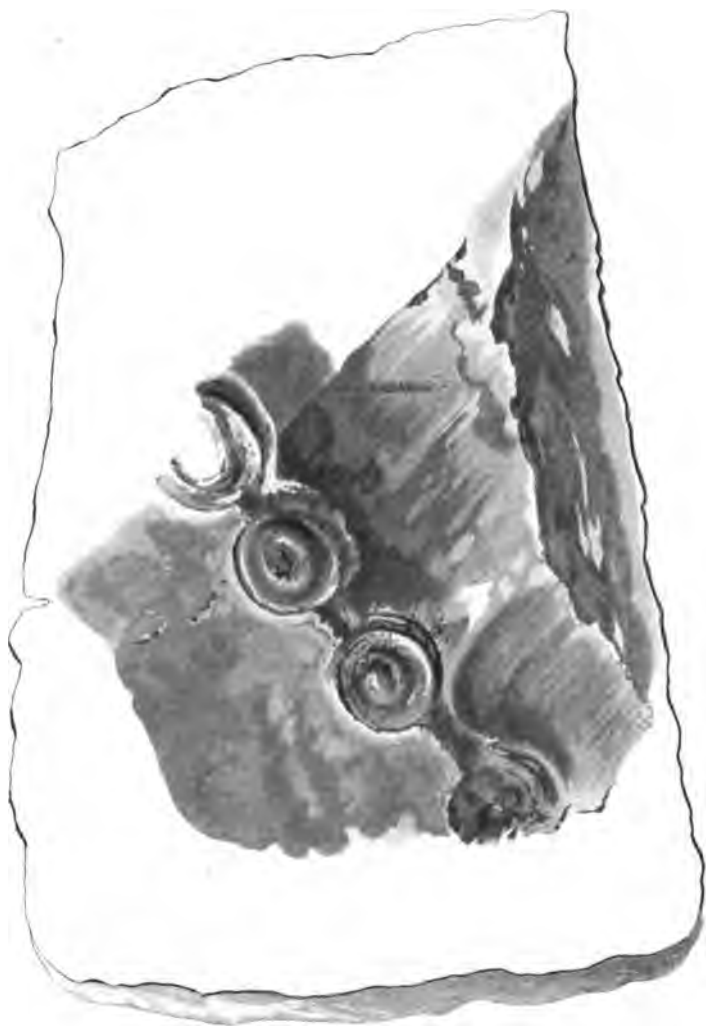
the absence of any distinct trace of a predominance of scales, is not only against its relationship to the Fir Tribe, but also to *Cycadeæ* and *Proteaceæ*.

It is more probable that it was related to some such order as *Pandaneæ* or *Artocarpeæ*. The great objection to the latter is the thickness of the ends of the pericarpia, and the apparent absence of bracteal scales. Such objections do not apply to *Pandaneæ*, the fruit of which is spheroidal, and consists in like manner of pericarpia, often with a thickened wedge-shaped apex, planted upon an axis destitute of bracteal scales, and originally one-celled, although often collected into parcels; and it is to this family of recent plants, that we should be inclined to refer this, if we were obliged to give a positive opinion. But for the present we prefer leaving it in the provisional genus *Strobilites*, in the hope that the daily multiplying evidence upon this subject will soon enable us to ascertain its nature in a more satisfactory manner.

CYCLOCLADIA MAJOR.

From the roof of the Bensham Coal-seam at Jarrow Colliery.

Like *Bothrodendron* this plant has branches (?) which readily disarticulated with the stem. All that has been seen of it is in the form of circular depressions about four-tenths of an inch in diameter, arranged in whorls. Its leaves, and the surface of its stem, are quite unknown. What it may have been it would be useless under such circumstances even to conjecture; but as it appears totally distinct as a genus, from all published fossils, we have given it a name by which it may be called. We have another specimen from the coal measures of what seems to be a smaller species (*Cyclocladia minor*), the diameter of whose scars does not exceed five-twentieths of an inch, but we do not remark any further difference.





Natural Size



Natural Size



Magnified

SPHENOPTERIS WILLIAMSONIS.

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- Sphenopteris digitata.* Phillips *Geol. of Yorkshire*, p. 147.
t. 8, f. 6, 7.
- Sphenopteris Williamsonis.* Ad. Brong. *Hist. des Vég. Foss.*
vol. 1, page 177, t. 49, fig. 6, 7, 8.
-

The accompanying plate represents finer specimens of this species, than M. Adolphe Brongniart has figured. The drawings were communicated by our indefatigable correspondent, Mr. Williamson, Jun., from the Oolitic deposit at Gristhorpe Bay, near Scarborough, where the species is rare.

The pinnules are narrowly wedge-shaped, truncated, often two-lobed, and placed in a somewhat irregular manner; they often appear two-parted to their very base, each division being lobed almost in a fan-shaped manner.

bable that *Otopteris* will have to be reinforced with *Neuropteris Dufresnoii*; but of this we are uncertain, having seen no specimens. In the meanwhile the generic and specific characters of *Otopteris* may be stated thus—

OTOPTERIS.

Leaf pinnated. Leaflets originating obliquely from the side of the leaf-stalk, auricled, attached by about half their base, destitute of all trace of midrib. Veins of equal size, very closely arranged, diverging from their point of origin, and dividing dichotomously at an exceedingly acute angle.

1. *Otopteris obtusa*. Leaflets narrow, oblong, falcate, very obtuse.—From the Lias. Plate cxxviii.

2. *Otopteris acuminata*. Leaflets oblong-lanceolate, acuminate, slightly falcate.—Oolite. Plate cxxxii.

3. *Otopteris Beanii*. Leaflets roundish-oblong, somewhat lozenge-shaped, very unequal sided.—Oolite.

SYN. *Cyclopteris Beanii*. *Fossil Flora*, vol. 1, t. 44.

? 4. *Otopteris Dufresnoii*. Leaflets broadly oblong, obtuse, scarcely falcate, auricled on the lower side.—New Red Sandstone.

SYN. *Neuropteris Dufresnoii*. *Ad. Brong. Hist. Vég. Foss.* p. 246, t. 74, f. 4; and 5?

ASTEROPHYLLITES JUBATA.

From the coal measures at Jarrow Colliery.

A thick, blunt, faintly striated, jointed stem, something like that of a Calamite, covered here and there with the remains of a thin carbonaceous layer of what may have been bark, and bearing a multitude of extremely fine thread-like long processes, which it is to be presumed were leaves, are all that we know of this fossil; which we place in the genus *Asterophyllites*, simply because it accords with the verbal character of that heterogeneous assemblage.

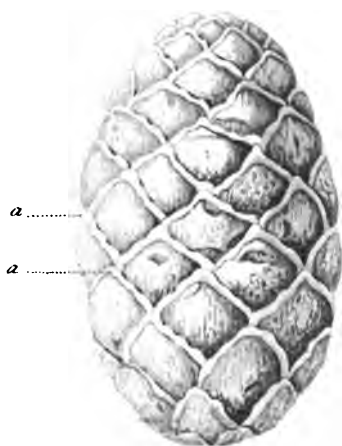
It looks more like a gigantic *Equisetum* than any thing modern we are acquainted with, but in reality it possesses no character which enables a Botanist to form an opinion about it. All that can be safely said concerning it is that it is a new form in the Flora of the Coal measures.



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Natural Size



A



Magnified

B

PINUS PRIMÆVA.

For the discovery of this we are indebted to Gilbert Flesher, Esq. of Towcester, who found one specimen in the stone pits at Burcott Wood, near that place, and another, which was presented to the Marquess of Chandos, in Livingstone stone pits. Dr. Buckland informs us that the formation belongs to the Inferior Oolite.

This we regard as the nearest approach to the modern European form of vegetation in the rocks of such high antiquity as those of the Oolite; for after a careful examination of it in different directions, we have come to the conclusion that it has no characters to distinguish it from a modern *Pinus*.

It is a cone, which at the time of its deposit had lost its seeds, and had its scales wide apart, like those of a Scotch Fir cone, which has been lying

about for some months exposed to weather. Wet earthy matter insinuated itself beneath the scales, filled up all the cavity beneath them, and at the same time, by moistening them, relaxed their tissue and closed them back again, so as to restore the cone to its original shape. The earthy matter thus formed plates interposed between the scales, and when the latter, which we must suppose were originally decayed at their points, were broken away by the separation of the cone from its bed, projected beyond the scales in the form of a hard earthy border to each scale (*fig. A. a a*).

The specimen we are describing is nine-tenths of an inch long, of an oblong regular figure. It is composed of scales six deep, and six round, the ends of which are rounded, and have a transverse lozenge form; their surface is finely punctured in consequence of the cellular substance being laid bare by the rotting away of the cuticle and extreme parts. Each scale is dilated at its extremity, and gradually thins away to the lengthened axis (*fig. B.*) of which no trace remains.

The only points in this description at variance with the structure of a recent pine cone, are firstly, the small size of the fossil: this is botanically of only specific importance; and secondly, the rounded ends of the scales. In most modern Pines the end of the scales is distinctly and sharply angular; but *Pinus Strobus* has no angles at the extremity of its scales, and from the worn state of those of the

fossil it is most likely that the angles would have crumbled away had there ever been any.

We therefore consider it a true *Pinus*. That it cannot be referred to any other genus of Coniferæ, to which it bears external resemblance, is easily shewn. *Abies*, which, in the form of the Larch, agrees with this in the size of its cones, has scales without thickened extremities. *Taxodium*, the points of whose scales are lozenge-shaped, and which agrees with it in the size of its cones, has no perceptible axis to its fruit, but all its scales spring from a central point. *Voltzia*, which, from its station in the New Red Sandstone, one would naturally compare with it, has all its scales distinctly 3-lobed ; and we may add, that this latter circumstance also distinguishes it at once from *Alnus*, whose woody cones, when full ripe, are as large as that of the fossil.

ZAMIA CRASSA.

Communicated by Dr. Buckland from the Wealden formation at Yarenland, in the Isle of Wight, where it was found by Mr. John Smith, by whom it was presented to the Oxford Museum, along with a great number of very large bones of *Iguanodon* from the same locality.

The cones appear to have been something more than two inches long, but as their base is lost we cannot be certain of the precise dimensions ; now that they are pressed nearly flat they are an inch and half across ; they are regularly oblong, and rounded at the extremity. Their surface is covered with deep black, rather irregular, transversely lozenge-shaped scales, which are changed to a brittle carbonaceous matter. Upon cutting through one of these cones, the internal structure, although slightly, is still sufficiently retained to shew that there were numerous seeds, lying below the thick-

ened scales at a considerable distance from a thick axis. These are shewn at *a, a, a*, in the lower figure. Nothing can be made of their relation to the scales, except that they are placed immediately below the thickened ends of the latter.

This circumstance disposes of the affinity of the plant which bore these cones to Coniferae, for in all genera of that order the seeds are next the axis of the cone. And the same point seems to establish their relation to *Zamia*, to which genus we see no reason why they should not be positively referred: especially considering the existence of other remains of such plants in rocks of a similar age to that of the Wealden clay.

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ABIES OBLONGA.

Communicated by Dr. Buckland, who believes it to be from the Greensand, near Lyme Regis. It had been washed out of the cliff and rolled to a pebble by the waves on the Dresent shore.

The cone is rather more than two inches and a half long, but was probably longer, for it has been so worn down by constant friction, that its very axis is cut into, and the seeds of the lower part of the cone are laid bare in consequence of the scales that protected them being ground away. Under these circumstances it must not be expected that the external appearance of the fossil is much like what it was when fresh.

Its scales are very broad, rounded, and quite thin at the points ; near the axis they are thicker, and apparently consisted of a woody central plate, deeply covered with a corky tissue, which gave way to the pressure of the seeds, forming niches for their reception.

The seeds are so perfectly shewn in a longitudinal section (fig. 2), that not only is their form ascertained to be oval, and their situation at the base of the scales, but in one instance their very embryo may be perceived lying in the midst of albumen. This has been overlooked by our artist, but is plainly visible near the base of one of the halves into which the cone has been cut.

As the position of the seeds near the base of the scales, in connection with other characters, shews this to be *Coniferous*, and as *Abies* is distinguished from *Pinus* by the thinness of the ends of the scales, we have no hesitation about placing this in the former genus, of which it is the second fossil species that has been discovered. To the other, named *A. laricoides* by Adolphe Brongniart, no locality is assigned.

That such a genus should exist in the Greensand will be by no means improbable if the beds at Tittschen, at Heidelberg, Quedlinburg, and Blankenburg, containing the leaves of Dicotyledonous trees, are correctly referred to that formation.

SPHENOPTERIS CAUDATA.

Sphenopteris caudata. *Supra*, vol. 1. t. 48.

From the shale of Jarrow Colliery.

We trust to be pardoned for republishing this plant now that we have procured tolerably complete specimens; that which was represented at Plate 48, of our first volume, having been taken from very imperfect fragments.

The impression before us is about a foot long, and comprehends a considerable portion of the upper part either of an entire leaf, or of one of the lateral divisions of a thrice pinnated leaf of considerable size; one of the pinnæ only and a few fragments, are shewn in our plate.

The pinnæ were set on their rachis at intervals of about an inch and a half; becoming closer towards

CAULOPTERIS PHILLIPSII.

For a drawing of this very distinct species of Tree Fern stem, we are indebted to Professor Phillips, who communicated it with the following note.

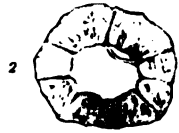
"This is the plaster cast of a fossil stem from Camerton Colliery in Somersetshire, where the specimen was, I believe, found in the year 1800. It was, I think, in the possession of the late C. J. Harford, Esq. a friend of the late Rev. J. Townsend of Pewsey (author of a well known geological work, embodying many of Mr. W. Smith's early views) and of the late Rev. Benjamin Richardson of Farley, in whose collection this plaster cast was preserved. It was given to me by Mrs. Richardson in 1833. I consider it to be the stem of a Tree Fern, different probably from any yet published. I may remark that I have never seen any fossil stem which appeared to possess the character of a Tree Fern

from any British Coal-field except that of Somersetshire.

“No particular markings are observable in the cast between the cicatrices, but the intervening spaces appear nearly smooth. The cicatricial markings are not all similar, and I find on some recent Tree Ferns considerable variation in this respect, arising apparently from the singular rupture of the vessels, &c.

“The cast includes probably the greater part of the breadth of the plant; it is of an oval figure in the cross section, in consequence of compression.”

It is obviously distinct from *C. primæva*, figured at tab. 42, and these together with the little *Caulopteris gracilis*, published at tab. 141 of the present number, form the only Tree Fern stems we yet have met with in the Coal Measures.



CAULOPTERIS GRACILIS.

An extremely rare fossil, belonging to the Ketley Coal-field. The only specimen we have seen was communicated to us by Mr. Prestwich, Jun., "from the shale of the Pinny Iron-stone measure, at the Hay-pits, Madeley; it was found associated with large quantities of marine shells." It also exists in the collection of Mr. Austin of Madeley.

Our specimen is a hollow cylinder, marked internally with deep and distinct longitudinal fissures, about half an inch long, alternating with each other, and piercing the whole thickness of the cylinder, so that where the latter is broken across it is separated into lobes of unequal width, as is shewn in our figure. Externally the surface is covered irregularly with elevated lines, which appear to be the remains of fibres that were attached firmly to the surface; it is also pierced here and there with fissures which communicate with the inside.

We know of nothing among recent plants to which this can be compared except a slender Fern-stem; with which we are disposed to identify it,

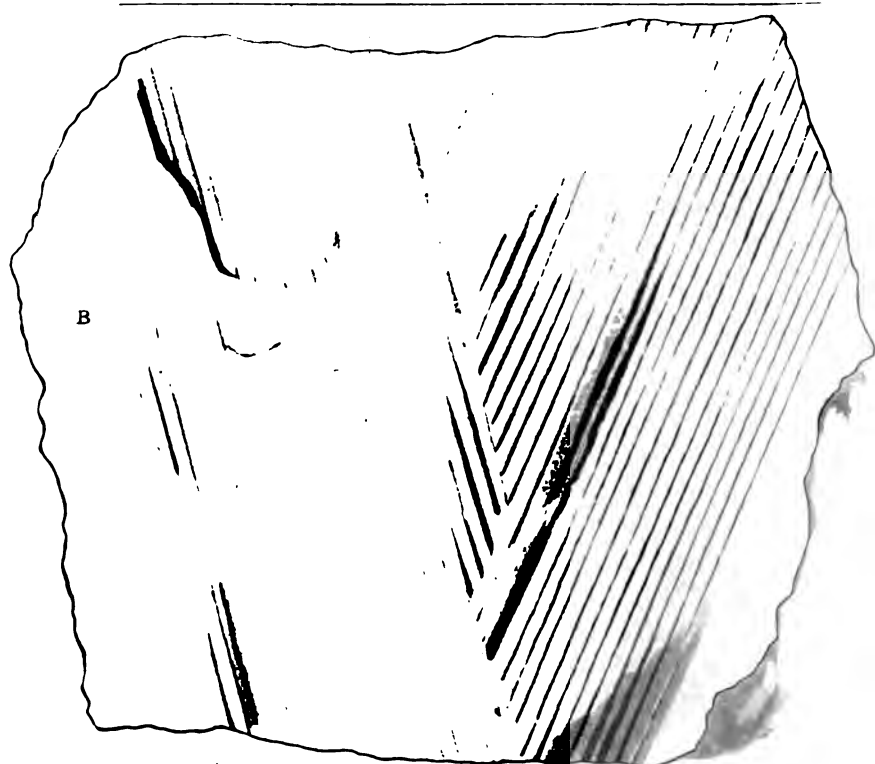
notwithstanding the absence of the scars of leaves, and its fibrous surface.

In all Tree Ferns the scars disappear towards the lower part of the stem, where their place is occupied by a layer of entangled fibres ; so that this, if a Fern stem, must have been the lower end of one.

The cylinder of which the trunk of a Tree Fern consists, is composed of a number of irregular lobes which are the bases of the leaves, adhering to each other by their sides ; in this specimen the fissures may be considered the lines of contact of such bases. We do not, however, know any recent Fern in which the bases of the leaves adhere to each other so slightly as to leave passages between them ; but in *Dicksonia arborea*, the internal furrows are so deep that this nearly happens.

Each base of a Fern leaf, consists of an external coating of a hard texture, and of a softer substance in which a number of sinuous plates are arranged. It often happens that the soft substance shrinks away from the hard outer case, thus leaving a space between the two ; precisely the same thing seems to have happened in this fossil (see fig. 2).

Upon the whole we regard it as tolerably certain that this was the base of a slender Fern-stem ; and upon this supposition we especially recommend it to the consideration of those who occupy themselves with the study of the economy of recent Fern-trunks. If we are not greatly mistaken, it is calculated to throw no inconsiderable degree of light upon what has hitherto been a very obscure subject.



TRIGONOCARPUM OVATUM.

Communicated by Mr. Prestwich, Jun., from the Pinny Iron-stone measure at Ketley: it is now in the collection of Mr. Austin of Madeley.

The existence of Palms at the time of the Coal measures has always been insisted upon as one of the many proofs that the Vegetation of the Coal æra was tropical; but this, like the arguments derived from the supposed existence of Tree Fern stems, has long been exposed to objections which are not easily answered. We have shewn, at table 42 of the first volume of this work, that up to the time when that article made its appearance, there had not been a single genuine Tree Fern stem described from the old Coal of any part of the world; now, with what are published in our present number, the existence of three English species will have been demonstrated. So with Palms; no one has yet seen *Palm-wood* in the Coal measures, only three kinds of *leaves* have been referred to this class,

and of those, one, the *Flabellaria Borassifolia*, is probably not a Palm at all ; while the other two, both belonging to the genus *Naggerathia*, are by no means so clearly proved to be Palms that a question could not be raised about them, especially in the absence of proof of the existence of other species ; and finally, doubts have been expressed by Adolphe Brongniart (*Prod. p.* 120), whether the fossil Coal fruits, supposed to belong to Palms, were not in fact something else.

Under these circumstances, we think we shall be rendering good service to Geology if we can succeed in producing tolerably good evidence, in two more cases, of the existence of Palms in this country at the time when the Coal was deposited, and a third which is supported upon testimony which the most scrupulous Botanist cannot gainsay.

The first to which we have to call attention is the subject of this article (t. 142, f. A). This was an ovate fruit, of the exact size shewn in our drawing, originally covered with a thin coat, which now remains in the form of a thin broken carbonaceous crust ; below this coat was a thick shell marked with three projecting ribs, and within the shell was a single seed which seems to have stood erect in the cavity ; all this is visible in our specimen, in consequence of the shell having been broken through from the apex, so as to lay bare the seed. The latter seems to have been soft at the time when it was converted into ironstone, for

there is a distinct trace of a deep depression in two places, just at the point where the shell is fractured. No trace of calyx, or of any other body is discernible externally.

Now all this is exactly what would be seen in many Palms, which have in like manner a three-ribbed fruit containing a single seed within a thick shell, and if their seed were decayed, its sides would give way just as has happened here, in consequence of its being hollow like the Cocoa-nut; such a Palm is the common Chilian *Micrococos*, which is so commonly sold in the market of Valparaiso. Supposing the apex of such a Palm could be laid bare by a fracture of the shell, as has occurred in our fossil, a number of veins would be seen passing downwards from the apex towards the base; traces of such a structure are distinctly visible here, only they are scarcely elevated above the surface of the seed, which may have been caused by the decay of the latter.

No doubt this is nearly allied to *Palmacites dubius* of Sternberg, which Brongniart calls *Trigonocarpum dubium*, but that species is both rounder and smaller.

POACITES COCOINA.

Obligingly communicated to us from the Lancashire Coal-field, by Dr. Black of Bolton.

The only two species we have seen of this, are the present, and another from Bideford, in Devonshire, among some vegetable fossils, collected by Mr. De la Beche, and in both the two parts of which the species consisted were placed obliquely with respect to each other, as is represented in the drawing; the one half having convex veins, and therefore shewing the lower surface, while the other half is proved by its concave veins, to have been the upper surface. It is evident that they were applied to each other face to face, and one would think that their relative position was caused by their having been doubled down upon each other.

From the great breadth of this leaf, and its apparent length, it could scarcely have been any thing except the leaf of some pinnated Palm, whose pinnæ are of considerable width, as in many species of

Cocos; at least we know of no other monocotyledonous leaf with which it can be compared.

Supposing this analogy to be a just one, it is not impossible that the position of the two faces, which seems to be caused by the leaf being doubled up, may be owing to the original structure of the leaf itself. For if it is the remains of a simply pinnated leaf, the under side might belong to one pinna, and the upper to another, pressed against each other in consequence of the leaf being folded up. And this we are the more inclined to suspect may be the case, in consequence of both the specimens we have seen, from distant localities, being in just the same state, a circumstance which would hardly have occurred if the doubling of the leaf were accidental.

This we regard then as a second new instance of the existence of Palms in the Coal measures.

TRIGONOCARPUM NÖGGERATHI.

Trigonocarpum Nöggerathi. *Ad. Brong. Prodr. p. 137.*
 Palmacites Nöggerathi. *Sternb. Tent. Fl. prin. p. xxxv.*
t. 55. f. 6, 7.

Whatever opinion may be held of the relation of the last two fossils to Palms, there cannot be the slightest as to this, for which we are also indebted to Dr. Black. It occurs in considerable quantity here and there, imbedded in sandstone, as if it had originally grown in large clusters: as was in all probability the case. We regard this as by far the most interesting fruit yet met with in the Coal measures.

It is possibly to this that Adolphe Brongniart alludes, when speaking of two or three species of hexagonal fruit, found in the Coal, which he considers cannot be Palm fruits, "because in all the genera of this family, when the fruit is symmetrical

it consists of three parts and not of six." Upon this we must remark, that although a six-sided figure is not common in Palma, yet it exists in *Diplothemium maritimum*; and that moreover this may be proved to be a Palm upon the clearest evidence.

The principal part of what we have examined consists of specimens of an ash grey colour, almost exactly oval, but more acute at one end than the other, and marked with three acute and three obtuse ribs, of which the latter are but little elevated. Fig. 1, represents a side view of one of them; 2, the base, and 3, the apex: in this there is nothing that can be called evidence. But upon fracturing a mass of sandstone, in which great numbers of fruits were imbedded, we were so fortunate as to obtain a distinct view of the internal structure, as represented at fig. 4; from which it appears that the fossil in its ordinary state, is an interior part divested of fleshy covering.

It consisted originally of a soft coat (fig. 4, *a.*), and was blunt at the apex, but tapered into a stalk (fig. 4, *e.*) at the base. Within this was another covering (fig. 4, *b.*), which enclosed a single seed. In the specimen the lower end of the seed was depressed as if it had been softened; in the centre (fig. 4, *c.*) it had a small round depression; and a number of veins passed downwards from its apex, losing themselves near the middle of the seed.

Now all this is so completely the structure of a

Palm, that there can be no doubt whatever that this fossil was the fruit of a plant of that kind ; indeed the depression in the centre (fig. 3, *c.*), which indicates the seat of the embryo, and the raphe so rich in veins, are to be found combined in no other plants.

In fact, let any one compare it with a Date-fruit, and it will be impossible not to recognize the great similarity in organization.

It is, however, very remarkable in this fossil, that although it has apparently the drupaceous structure of such fruits as the Cocoa-nuts, yet it has no pore provided for the escape of the embryo. It is impossible for so small and weak an organ as the embryo of a Palm to force its way through so hard and thick a covering as a Cocoa-nut shell, and, consequently, nature thins the shell over against the embryo, in order to enable the root of the latter to find its way into the earth ; this contrivance is seen on a Cocoa-nut shell, in the form of the three well known black spots at the end. It is to be expected that some trace of this contrivance would be discernible here ; but as that is not the case we must suppose that the second coat of the fruit, which answers to the stone, was in this instance soft enough to render such a provision as an embryo-pore unnecessary. Upon this supposition it will have belonged to a genus essentially distinct from any at present known.



Natural Size

CYCADEOIDEA PYGMÆA.

Communicated by Professor Buckland, from the lias at Lyme Regis. The specimen belongs to Miss Philpotts.

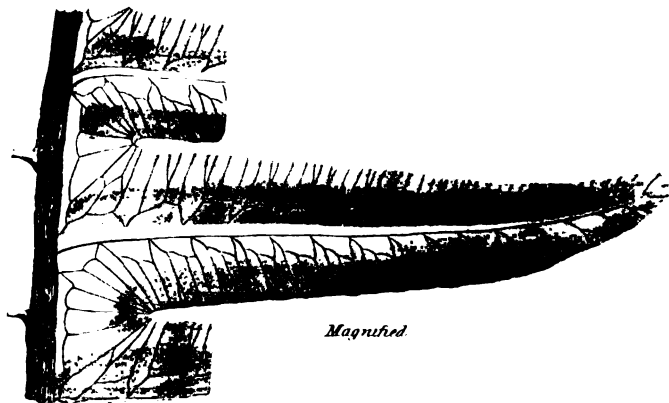
At first sight this might be taken for the cone of some tree; but the irregularity of its figure, and of the arrangement of the scars upon its surface, together with the appearance of a large tubercle on one side, will alone throw doubt upon the correctness of such an opinion; and this doubt is increased by the absence of all trace of seeds in a polished vertical section. When cut through from the apex to the base, nothing can be seen except the bases of blunt scales, planted perpendicularly upon a thick and solid centre.

In fact, we entertain little doubt that instead of a cone, we are to consider it as the stem of a small species of *Zamia*, analogous to those productions in the Isle of Portland, the real nature of which Profes-

"The central stem has tapered very rapidly, and is rather strongly striated. The greater part of it, however (as well as the central nerve of the leaflets), is decomposed as usual. The leaflets are alternate, slightly curved upwards, about one inch and a half long, terminating in an obtuse apex. The divisions do not quite descend to the central stem, but their place is occupied by a remarkable arrangement of the nerves, which will be better understood by the magnified drawing than by my describing it. The small spaces on each side of the main nerve are rather irregularly formed, sometimes opposite and in others alternate, but more frequently the former, so as to shew a string of curious heart-shaped appearances in the centre of each leaflet. The nervures are sometimes divided near the margin; about every second and third. I cannot discover any traces of the sori Brongniart mentions: they either do not exist in our specimen, or are very minute, and on the under side of the leaf, so as to be invisible. This is the only specimen I have seen: we have another which differs from this, in the nerves not dichotomizing at the margin."



Natural Size



Magnified

produced a very graceful habit in the living plant. The specimen is from the Coal Mines of the British Iron Company at Abersychan in Monmouthshire, and is the only one I have ever seen."

It does not appear to differ from *P. Mantelli*, of which Adolphe Brongniart has given a figure, from a specimen without the terminal pinnæ, communicated to him by Mr. Mantell, from the Newcastle Coal measures. That learned Geologist compares it with the common *Pecopteris lonchitica*; from which it is obviously to be distinguished by its very narrow and obtuse pinnæ, independently of the long terminal one. Like *Pecopteris heterophylla* it represents an extinct form of *Pteris*, of the nature of *Pteris caudata* and *aquilina*. Adolphe Brongniart regards it as intermediate between *Pteris caudata* and *arachnoidea*, two West Indian species.



SPHENOPTERIS CONWAYI.

For this also we are indebted to the same intelligent correspondent who furnished us with the last subject.

Mr. Conway observes, that "there appears to have been a very peculiar character belonging to this Fern. It seems to have been coriaceous and very thick, so as to give to the whole plant somewhat of a tuberculated appearance. Each portion of the leaflet appears as if formed of a separate globule, and the globules seem, by compression, to have been squeezed into each other, and thus to form one mass. This may possibly arise from the plants being in fructification. When the impression of the under side is left in the shale it is in very deep indentations; and, if these indentations are the impressions left by the sori, then they must have been arranged somewhat in the same manner as those on the *Aspidium Filix-mas* of the present day. The pinnules

are attached to the rachis by the whole of their base, and the veins radiate, as it were, from the base of each apparent tubercle of which the frond is composed, without any division or branching. This I have endeavoured to represent in a magnified portion. The only specimens I have seen are from Risca, in this county, and there, I understand, it is a common fossil."

Not having seen a specimen we are able to add but little to the foregoing remarks.

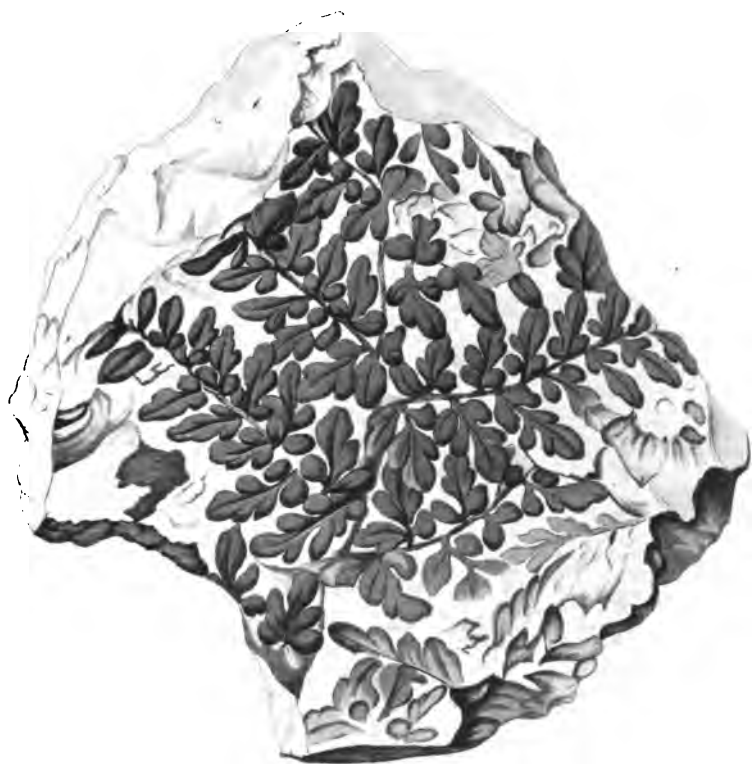
The fossil obviously belongs to the set of *Sphenopteris*, consisting of *S. Hæninghausi*, *rigida*, *trifoliolata*, and *obtusiloba*, which Adolphe Brongniart justly compares with the larger species of the modern genus *Cheilanthes*. They all are Coal measure plants, having that character of convexity in the lobes of the pinnules, which Mr. Conway justly describes as giving the plant a tubercular appearance. If, however, they were really related to *Cheilanthes*, it is to be remarked that this convexity was not owing to the pressure of a large central sorus beneath each lobe, but to the curving backwards of the edges of the lobes so as to cover the narrow marginal sori.

From the species described by Adolphe Brongniart, this differs essentially in the pinnules being seated close upon the rachis, and touching each other, so that to the naked eye the pinnæ look as if they were regularly pinnatifid with very short acute lobes. Each of these supposed lobes is in

reality a pinnule, consisting of three or five lobes, of which the lowest are much the largest, and the terminal one rather narrower and longer than the intermediate ones, if there is any of the latter present.

We have named it in compliment to the gentleman who has so obligingly communicated it to us; as a slight acknowledgment of the value we attach to his investigations of the highly interesting Coal flora of South Wales.

From the appearance of this specimen it may be conjectured that it was a Tree Fern; for although there may be some doubt whether the lateral ramifications are in all cases actually attached to the central rachis, yet the general relation borne to each other by the parts as they lie imbedded in the shale, is such as to render it highly probable that they all once belonged to each other. In this case the species would not be very widely different from the *Cheilanthes arborescens*, a Tree Fern which now inhabits the New Hebrides.



Magnified.

SPHENOPTERIS POLYPHYLLA.

Communicated by Mr. Murchison,* from the coal of the Titterstone Clee, in Shropshire, where it was found by Mr. Lewis.

* This, with many others, some of which form a part of the present Number, was collected by Mr. Murchison, during his recent geological surveys of Salop, Hereford, and the adjoining counties. These plants are from the Knowlsbury coal-field, a small elliptical basin, situated at the south-western termination of the carboniferous tract of the Titterstone Clee Hills. They occur chiefly in the roof of the 'great coal,' and 'gutter coal,' and also in the concretions of iron-stone. It is important to remark that in a Memoir lately read before the Geological Society, Mr. Murchison has shewn, that the Clee Hill coal-measures, as well as those of Coal-brook Dale, of the Wyne Forest, and of Oswestry, are all of *older date* than those of the Shrewsbury field. The latter containing a fresh-water limestone, and passing upwards into the base of the newer red sandstone, is proved to be the youngest of these carboniferous zones. It is from a portion of this Shrewsbury coal-field (Lebotwood), that we formerly published the specimens of *Neuropteris cordata*, *Odonopteris obtusa*, and *Cyperites bicarinata*, figured in our first volume, which plants Mr. Murchison has discovered in various parts of the same field, associated with *Pecopteris lonchitica*.

It is a very distinct species, allied to *Sph. obtusiloba*, but decidedly different in the lengthened form of the central piece in all the three-lobed segments of its leaves.

The leaves were bipinnated at least, and possibly more frequently divided; both the principal and secondary pinnæ were so closely placed that the lobes over-lapped each other. The segments of the pinnæ had an ovate, or somewhat heart-shaped figure, and were divided into from three to five lobes. When the lobes were five, the terminal one was not much longer than the others, but they all had a rounded termination, and the lateral were sometimes split; when the lobes were only three, the terminal one was always much longer than the two lateral ones, which near the point of the pinnæ became mere auricles and finally disappeared. The veins were wide apart and almost always forked.



W. Williamson del.

Det. by Mr. C. Ridgway London April 1835.

more distinct, and spread regularly from their origin, bifurcating as the lobe dilates.

This is nearly allied to *Sphenopteris adiantoides*, already figured at t. 115 of this work; but it differs essentially from that species in the tapering form of its pinnae, and in the division of its lobes. Whether it was pinnated or bipinnated the specimen does not enable us to determine. It is also closely related to *Sp. latifolia*, t. 156, but was a plant of a much larger size in all its parts.

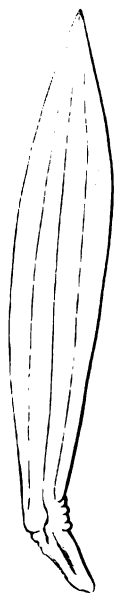


Fig. 3.



Fig. 1.



Fig. 2.

del.

but in that case the middle segment is usually two-lobed ; and finally it sometimes happens that the segments are all run very much together, so as to destroy the deeply pinnatifid character of the pinnæ. This is so remarkably the case in Adolphe Brongniart's upper right-hand figure, that one could hardly avoid doubting whether it is really a portion of the same plant, if one did not know how very variable a species this is.

In all cases the veins diverge from the base of each segment, and spread into the parenchyma by a regular system of forking ; they never approach each other near enough to give the lobes a streaked appearance to the naked eye.

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